



New Jersey Department of Environmental Protection
Land Use Management
Water Monitoring and Standards
Post Office Box 409, Trenton

Leslie J. McGeorge, Administrator

REAPPRAISAL OF
SHELLFISH GROWING AREA SE-7:
SUNSET LAKE TO CAPE MAY HARBOR
2000 – 2005
March 2007

Water Monitoring Report Prepared by:

Paul Wesighan
Project Manager

Bureau of Marine Water Monitoring
PO Box 405 Stoney Hill Road
Leeds Point, NJ 08220
Robert Connell, Bureau Chief

STATE OF NEW JERSEY

JON S. CORZINE

GOVERNOR

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2000 - 2005



New Jersey Department of Environmental Protection
LISA P. JACKSON
COMMISSIONER

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EXECUTIVE SUMMARY

Shellfish Growing Area SE-7; Sunset Lake to Cape May Harbor, is located in the southern part of New Jersey, north of Cape May and southwest of Wildwood, in Cape May County. The water quality data presented in this Reappraisal of Shellfish Growing Area SE-7; Sunset Lake to Cape May Harbor, was collected between October 2000 and September 2005, using the Systematic Random Sampling (SRS) strategy because there are no adverse pollution sources directly discharging into the waters of this shellfish growing area. The approximate size of this shellfish growing area is 2,525 acres, and the shellfish classification for this growing area is *Seasonally Approved (January to April)*, *Special Restricted* and *Prohibited* for shellfish harvesting (see Figure 1). All sampling stations were in compliance with the total coliform criteria for the *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* classifications of this shellfish growing area, as specified by the National Shellfish Sanitation Program (NSSP). No classification changes are recommended for this shellfish growing area. There were no observed changes to pollution sources of this area as documented in the shoreline survey included in this report.

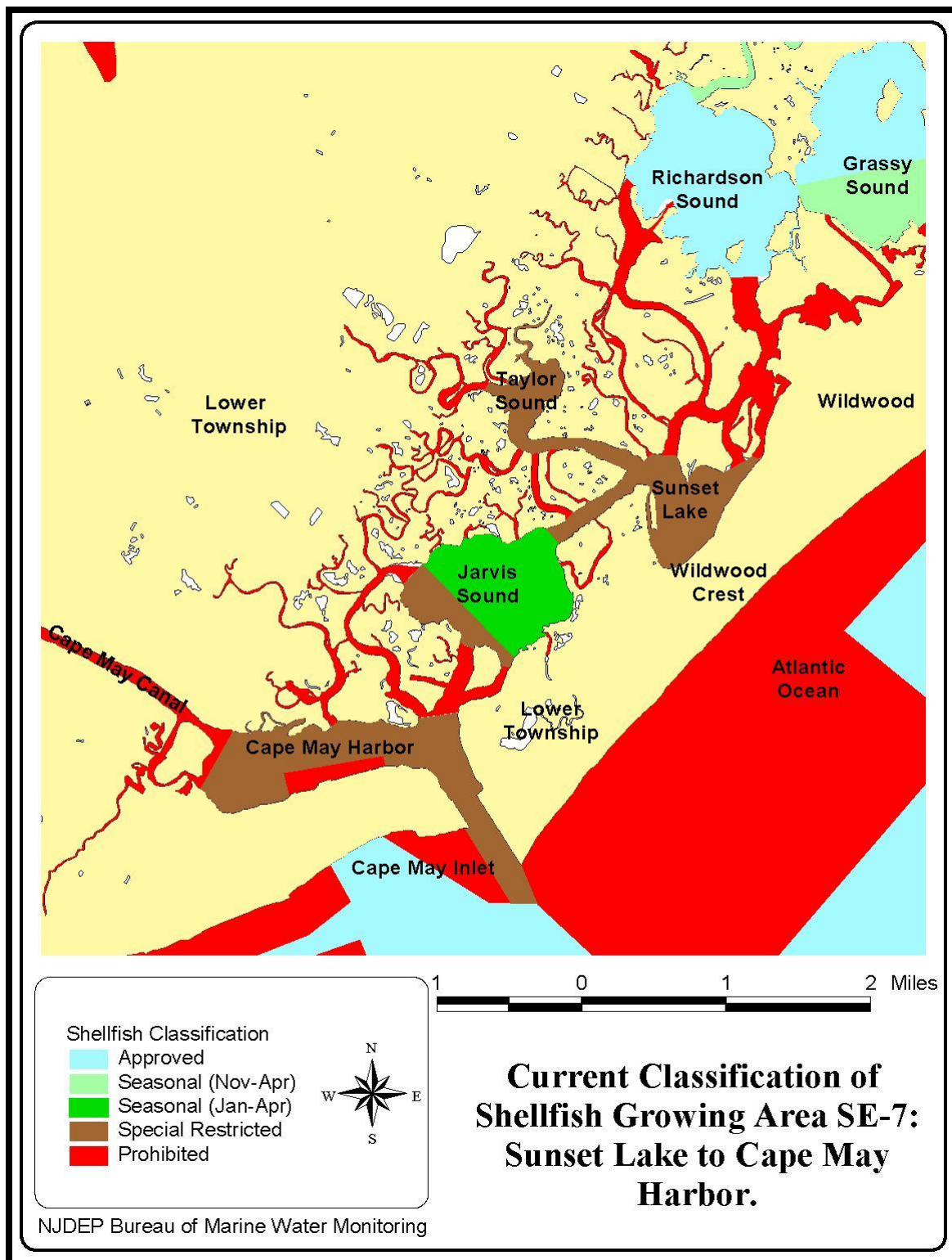


FIGURE 1: CURRENT CLASSIFICATION OF SHELLFISH GROWING AREA SE-7

INTRODUCTION

PURPOSE

This report is part of a series of studies having a dual purpose. The first and primary purpose is to comply with the guidelines of the National Shellfish Sanitation Program (NSSP) that are established by the Interstate Shellfish Sanitation Conference (ISSC). Reports generated under this program form the basis for classifying shellfish waters for the purpose of harvesting shellfish for human consumption. As such, they provide a critical link in protecting human health.

The second purpose is to provide input to the State Integrated Water Quality Inventory Monitoring and Assessment Report, which is prepared pursuant to Sections 305(b) and 303(d) of the Federal Clean Water Act (P.L. 95-217). The information contained in the growing area reports is used for the New Jersey State Water Quality Inventory Report (305b) portion of the Integrated Report, which provides an assessment to Congress every two years of current water quality conditions in the State's major rivers, lakes, estuaries, and ocean waters. The reports provide valuable information for the 305(b) portion of the Integrated Report, which describes the waters that are attaining state designated water uses and national clean water goals; the pollution problems identified in surface waters; and the actual or potential sources of pollution. Similarly, the reports utilize relevant information contained in the 305(b) portion of the Integrated Report, since the latter assessments are based on instream monitoring data (temperature, oxygen,

pH, total and fecal coliform bacteria, nutrients, solids, ammonia and metals), land-use profiles, drainage basin characteristics and other pollution source information.

From the perspective of the Shellfish Classification Program, the reciprocal use of water quality information from reports represent two sides of the same coin: the growing area report focuses on the estuary itself, while the 305(b) portion of the report describes the watershed that drains to that estuary.

The Department participates in a cooperative National Environmental Performance Partnership System (NEPPS) with the USEPA which emphasizes ongoing evaluation of issues associated with environmental regulation, including assessing impacts on water bodies and measuring improvements in various indicators of environmental health. The shellfish growing area reports are intended to provide a brief assessment of the growing area, with particular emphasis on those factors that affect the quantity and quality of the shellfish resource. The shellfish growing area reports provide valuable information on the overall quality of the saline waters in the most downstream sections of each major watershed. In addition, the reports assess the quality of the biological resource and provide a reliable indicator of potential areas of concern and/or areas where additional information is needed to accurately assess watershed dynamics.

HISTORY OF NSSP

As a brief history, the NSSP developed from public health principles and program controls formulated at the original conference on shellfish sanitation called by the Surgeon General of the United States Public Health Service in 1925. This conference was called after oysters were implicated in causing over 1500 cases of typhoid fever and 150 deaths in 1924. The tripartite cooperative program (federal, state and shellfish industry) has updated the program procedures and guidelines through workshops held periodically until 1977. Because of concern by many states that the NSSP guidelines were not being enforced uniformly, a delegation of state shellfish officials from 22 states met in 1982 in Annapolis, Maryland, and formed the ISSC. The first annual meeting was held in 1983 and the group continues to meet annually at various locations throughout the United States.

The NSSP *Guide for the Control of Molluscan Shellfish* sets forth the principles and requirements for the sanitary control of shellfish produced and shipped in interstate commerce in the United States. It provides the basis

used by the Federal Food and Drug Administration (FDA) in evaluating state shellfish sanitation programs. The five major points on which the FDA evaluates the state include:

1. The classification of all actual and potential shellfish growing areas as to their suitability for shellfish harvesting.
2. The control of the harvesting of shellfish from areas that are classified as restricted, prohibited or otherwise closed.
3. The regulation and supervision of shellfish resource recovery programs.
4. The ability to restrict the harvest of shellfish from areas in a public health emergency, and
5. Prevention of the sale, shipment or possession of shellfish that cannot be identified as being produced in accordance with the NSSP and have the ability to condemn, seize or embargo such shellfish.

FUNCTIONAL AUTHORITY

The authority to carry out these functions is divided between the Department of Environmental Protection (DEP), the Department of Health and Senior Services, and the Department of Law and Public Safety. The Bureau of Marine Water Monitoring (BMWM), under the authority of N.J.S.A. 58:24, classifies the shellfish growing waters and administers the special resource

recovery programs. Regulations delineating the growing areas are promulgated at N.J.A.C. 7:12 and are revised annually. Special Permit rules are also found at N.J.A.C. 7:12 and are revised as necessary.

The Bureau of Shellfisheries, in the Division of Fish and Wildlife, issues harvesting licenses and leases for

shellfish grounds under the Authority of N.J.S.A. 50:2 and N.J.A.C. 7:25. This bureau, in conjunction with the BMWWM, administers the Hard Clam Relay Program.

The Bureau of Law Enforcement in the DEP, Division of Fish and Wildlife, and the Division of State Police, in the Department of Law and Public Safety, enforce the provisions of the statutes and rules mentioned above.

The Department of Health and Senior Services is responsible for the certification of wholesale shellfish establishments and, in conjunction with the BMWWM, administers the depuration program.

The division of authority between the three agencies can be seen in Figure 2.

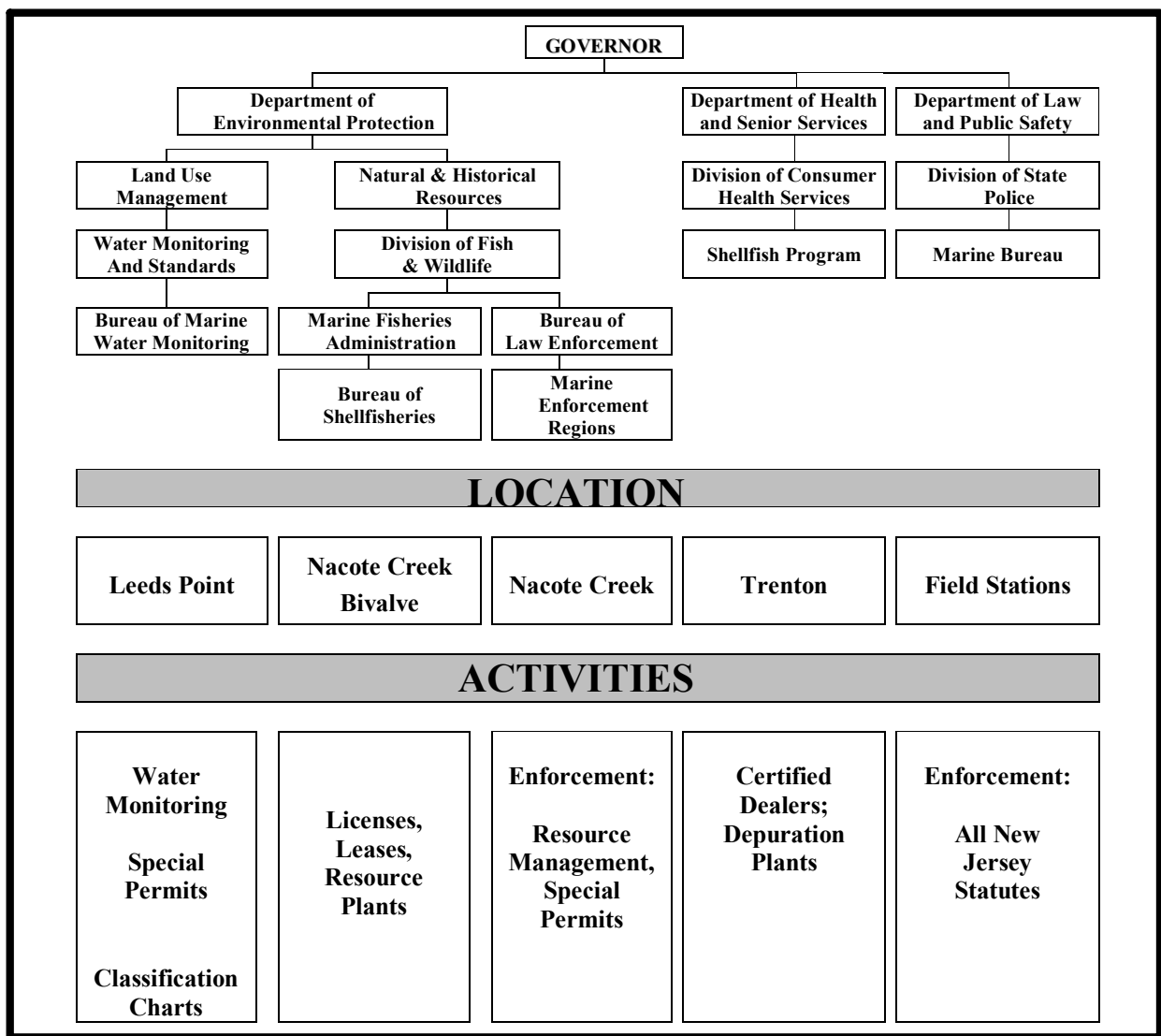


FIGURE 2: STATE OF NEW JERSEY SHELLFISH AGENCIES

IMPORTANCE OF SANITARY CONTROL OF SHELLFISH

Emphasis is placed on the sanitary control of shellfish because of the direct relationship between pollution of shellfish growing areas and the transmission of diseases to humans. Shellfish-borne infectious diseases are generally transmitted via a fecal-oral route. The pathway is complex and quite circuitous. The cycle usually begins with fecal contamination of the shellfish growing waters. Sources of such contamination are many and varied. Contamination reaches the waterways

via stormwater runoff from urban and agricultural areas and from direct discharges such as wastewater treatment facilities.

Clams, oysters and mussels pump large quantities of water through their bodies during the normal feeding process. During this process the shellfish also concentrate microorganisms, which may include pathogenic microbes, and toxic heavy metals/chemicals. It is imperative that a system is in place to reduce the

human health risk of consuming shellfish from areas of contamination.

Accurate classifications of shellfish growing areas are completed through a comprehensive sanitary survey. The principal components of the sanitary survey report include:

1. An evaluation of all actual and potential sources of pollution,
2. An evaluation of the hydrography of the area and,
3. An assessment of water quality. Complete intensive sanitary surveys are conducted every 12 years with interim narrative evaluations (Reappraisals) completed on a three year basis. If major changes to the shoreline or bacterial quality occur, then the

intensive report (Sanitary Survey) is initiated prior to its 12 year schedule. Also, if only a section of a growing area is either upgraded or downgraded from its current shellfish classification, a partial intensive report (Partial Sanitary Survey) is conducted for that shellfish growing area. Annual Reviews are written on a yearly basis for each shellfish growing area.

The following narrative constitutes the BMW's assessment of the above mentioned components to comply with the three year reappraisal and to determine the current classification of the shellfish growing waters of Shellfish Growing Area SE-7, Sunset Lake to Cape May Harbor.

GROWING AREA PROFILE

LOCATION

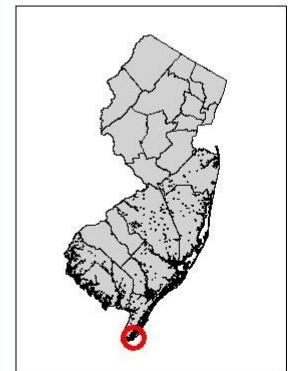
Shellfish Growing Area SE-7; Sunset Lake to Cape May Harbor, is located in the southern part of New Jersey, north of Cape May and southwest of Wildwood, in Cape May County (see Figure 3). These shellfish growing waters are bordered to the north by Middle Township, to the east by Wildwood,

Wildwood Crest, and Lower Township, to the west by Lower Township, and to the south by Cape May. The locations of the adjacent municipalities are shown in Figure 3, and the population statistics for the adjacent municipalities are shown in Table 1 (NJ Department of Labor, 2001).

The Location and Municipalities of Shellfish Growing Area SE-7: Sunset Lake to Cape May Harbor



Area SE-7 includes the shellfish growing area south of Richardson Sound in Middle Township to Cape May Harbor, north of the city of Cape May in Cape May County.



NJDEP Bureau of Marine Water Monitoring

FIGURE 3: LOCATION AND MUNICIPALITIES OF SHELLFISH GROWING AREA SE - 7: SUNSET LAKE TO CAPE MAY HARBOR.

TABLE 1: POPULATION STATISTICS FOR MUNICIPALITIES ADJACENT TO SHELLFISH GROWING AREA SE-7: SUNSET LAKE TO CAPE MAY HARBOR (NJ DEPARTMENT OF LABOR, 2001).

Community	Area (sq. mi.)	Population (2000 Census)	Population Density (Persons/ sq.mi.)
Middle Township	82.80 sq.mi.	16,405	198
Wildwood	1.43 sq.mi.	5,436	3,801
Wildwood Crest	1.43 sq.mi.	3,980	2,783
Lower Township	31.21 sq.mi.	22,945	735
Cape May	2.61 sq.mi.	4,034	1,546



FIGURE 4: LOCATION OF THE SOUTH PART OF THE CAPE MAY HARBOR. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 8:42 A.M.



FIGURE 5: LOCATION OF THE WEST PART OF THE CAPE MAY HARBOR. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 8:56 A.M.



FIGURE 6: LOCATION OF THE OCEAN DRIVE BASCULE BRIDGE EXTENDING OVER MIDDLE THOROFARE. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 9:25 A.M.



FIGURE 7: LOCATION OF THE SOUTHWEST SHORELINE OF JARVIS SOUND. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 9:45 A.M.



FIGURE 8: LOCATION OF SUNSET LAKE , WEST OF WILDWOOD CREST. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 10:03 A.M.

DESCRIPTION

The area from Sunset Lake to Cape May Harbor and the waters that drain into the Cape May Inlet, are located in Cape May County, New Jersey. The principal bodies of water in this area are Taylor Sound, Sunset Lake, Jarvis Sound, Cape May Harbor, and Cape May Inlet (see Figures 4, 5, 7, and 8). This area also includes Richardson Channel, Grassy Sound Channel, Shaw Cutoff, Stites Creek, Swain Channel, Jarvis Sound Thorofare, Reubens Thorofare, Upper Thorofare, Middle Thorofare, Lower Thorofare, Skunk Sound, and part of the Cape May Canal (see Figure 6). The approximate size of this shellfish growing area is 2,525 acres, and the shellfish classification for this growing area is *Seasonally Approved (January to April)*, *Special Restricted* and *Prohibited* for shellfish harvesting. There are approximately 349 acres of *Seasonally Approved (January to April)* waters,

1,078 acres of *Special Restricted* waters, and 1,098 acres of *Prohibited* waters in this shellfish growing area. The *Seasonally Approved (January to April)* waters are located in the north part of Jarvis Sound. The *Special Restricted* waters are located in Taylor Sound, Swain Channel, Sunset Lake, the Intracoastal Waterway extending from Swain Channel to Jarvis Sound, Jarvis Sound, the Cape May Harbor, and the Cape May Inlet. The *Prohibited* waters include the rest of the waters in this shellfish growing area. Tidal flushing of this area mainly occurs through the Cape May Inlet.

This shellfish growing area can be found on Chart 9 of the “2005 State of New Jersey – Shellfish Growing Water Classification Charts” (NJDEP, 2005). Figure 9 shows the current classification of this shellfish growing area.

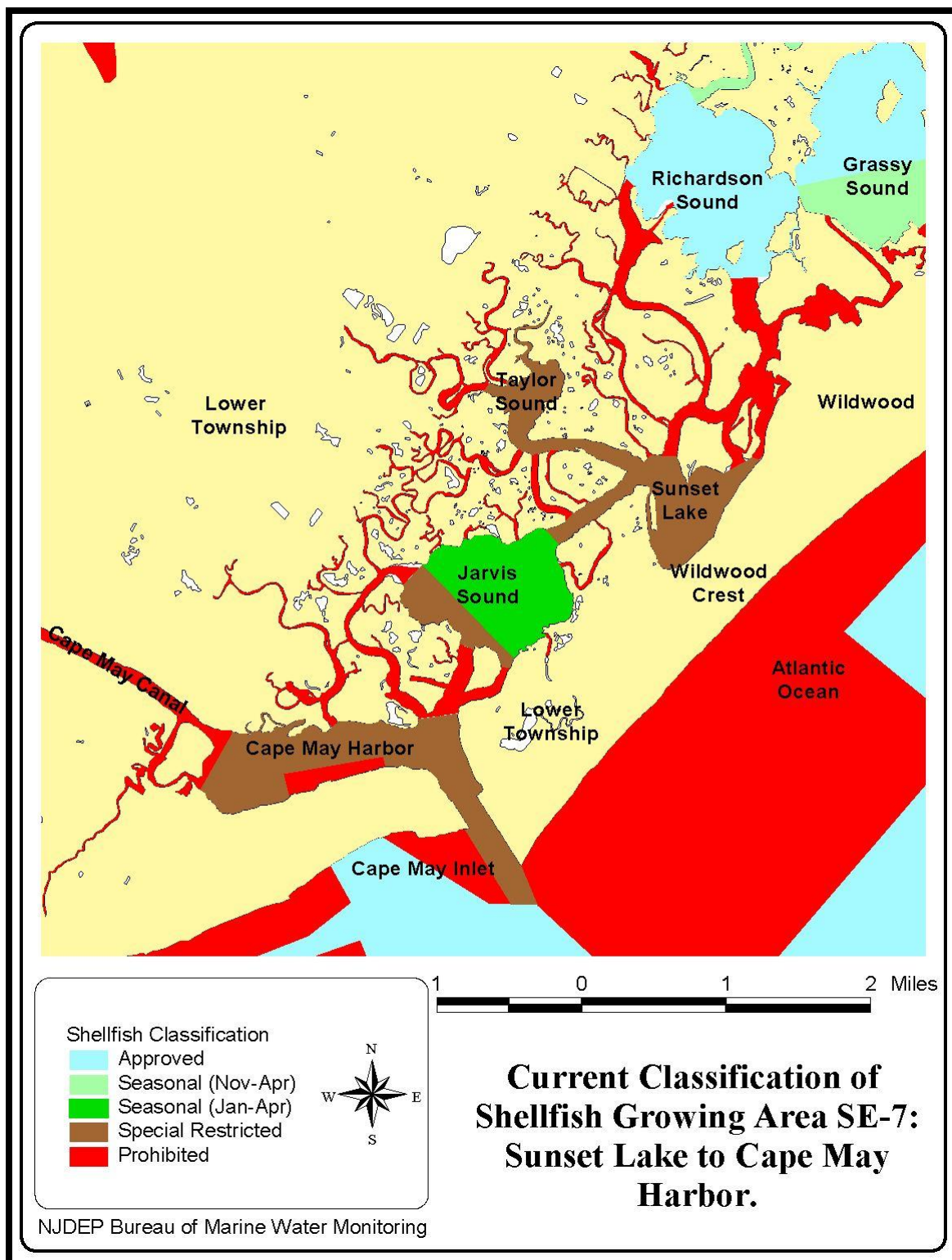


FIGURE 9: CURRENT CLASSIFICATION OF SHELLFISH GROWING AREA SE-7

HISTORY OF GROWING AREA CLASSIFICATION

Before 1970, this entire shellfish growing area was classified as *Prohibited* waters. It was not until 1970 that certain parts of this area were upgraded to the *Special Restricted* classification based on water quality.

Prior to 1996, this shellfish growing area was composed of two sampling assignment areas (assignments 277 and 278). An assignment area includes all of the sampling stations that can reasonably be sampled in a day in a specified area, which are sampled using the same sampling strategy. In the 1996-1997 scheduled runs for this area, both assignment areas were consolidated into one assignment area (assignment 277) and this area was sampled using the Adverse Pollution Condition (APC) Strategy (the adverse condition was rainfall priority).

In October 1996, a reevaluation of this shellfish growing area was written using data from 1988 to 1996, and 325 acres were upgraded from *Prohibited* to *Special Restricted*. For the 1997-1998

sampling years, the sampling strategy was changed from Adverse Pollution Condition (APC) to Systematic Random Sampling (SRS) Strategy due to improvement in the water quality of Sunset Lake.

The last Sanitary Survey for Shellfish Growing Area SE-7 (Jarvis Sound and Cape May Harbor) was written in 2003. In this report, 349 acres of *Special Restricted* waters in the north part of Jarvis Sound were upgraded to the *Seasonally Approved (January to April)* shellfish classification based on an improvement in the water quality of this area.

In the 2004 Annual Review of Shellfish Growing Area SE-7, no classification change was proposed for this shellfish growing area (NJDEP, 2004). No sampling stations in this shellfish growing area exceeded the existing shellfish classification criteria, and the data supported the existing shellfish classifications for this area.

METHODS

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 1992).

Approximately 1,918 water samples were collected for total and fecal coliform bacteria between 2000 and 2005 and analyzed by the three tube MPN (Most Probable Number) method (the indicator density of bacteria colonies most likely to produce a particular combination of

positive and negative results in test tubes) (American Public Health Association, 1970). Figure 10 shows the Shellfish Growing Water Quality monitoring stations in the Sunset Lake to Cape May Harbor area. Approximately 47 stations are monitored during each year in the growing area. Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan*

Shellfish, 1999 Revision (USPHS, 1999 Revision).

Data management and analysis was accomplished using database applications

developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS: ARCVIEW®).

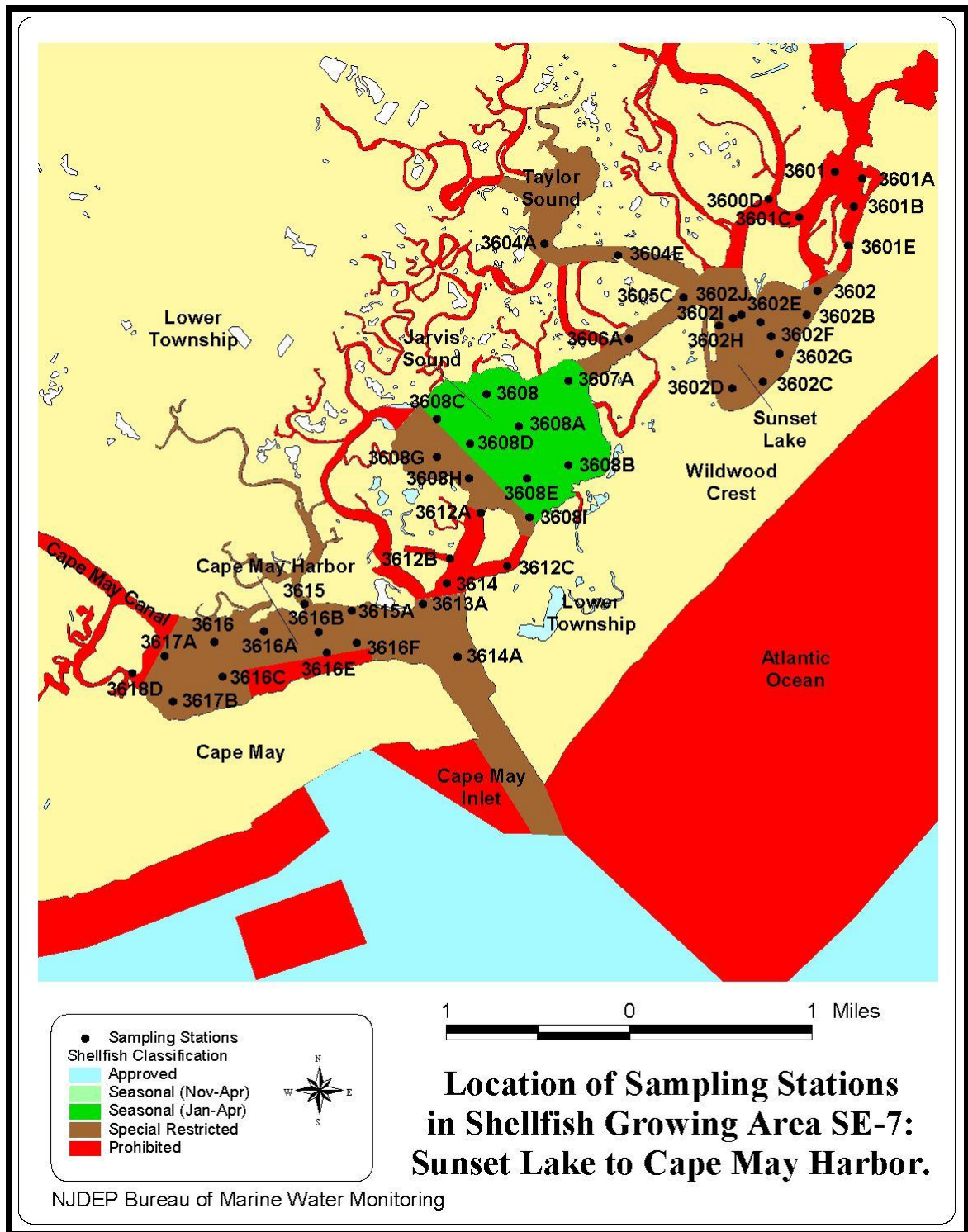


FIGURE 10: SRS SAMPLING STATIONS IN SHELLFISH GROWING AREA SE-7

BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS

The water quality of each growing area must be evaluated before an area can be classified as *Approved*, *Seasonally Approved (November to April)*, *Seasonally Approved (January to April)*, *Special Restricted*, or *Prohibited*. Criteria

for bacterial acceptability of shellfish growing waters are provided in *NSSP Guide for the Control of Molluscan Shellfish*, 1999 Revision (USPHS, 1999 Revision).

SAMPLING STRATEGY

The State Shellfish Control Authority has the option of choosing one of two water monitoring sampling strategies for each growing area.

The Adverse Pollution Condition (APC) strategy requires that a minimum of five samples be collected each year under conditions that have historically resulted in elevated coliform levels in the particular growing area. The results must be evaluated by adding the individual station sample results to the preexisting bacteriological sampling results to constitute a data set of at least 15 samples for each station. The adverse pollution conditions usually are related to tide and rainfall, but could be from a point source of pollution or variation could occur during a specific time of the year (Connell, 1991).

The Systematic Random Sampling (SRS) strategy requires that a random sampling plan be in place before field sampling begins. This strategy can only be used in areas that are not affected by point sources of contamination. A minimum of six samples per station are to be collected each year and added to the database to obtain a sample size of 30 for statistical analysis.

This shellfish growing area was sampled using the Systematic Random Sampling (SRS) strategy year-round for all of the sampling stations in this shellfish growing area (Assignment 277) because there are no adverse pollution sources directly discharging into the waters of this shellfish growing area.

NSSP CRITERIA

Each shellfish-producing state is directed to adopt either the total coliform criterion, or the fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, it does make corresponding fecal coliform determinations for each sampling station. These data are viewed as adjunct information and are not directly used for classification.

The criteria was developed to ensure that shellfish harvested from the designated waters would be free of pathogenic (disease-producing) bacteria. Each classification criterion is composed of a measure of the statistical ‘central tendency’ (geometric mean) and the relative variability of the data set. For the Adverse Pollution Condition sampling strategy, variability is expressed as the

percentage that exceeds the variability criteria (see Table 2). For the Systematic Random Sampling strategy, variability is expressed as the 90th percentile (see Table 3).

Areas to be “Approved” under the *Seasonal* classification must be sampled and meet the criterion during the time of the year that it is approved for the harvest of shellfish.

TABLE 2: CRITERIA FOR ADVERSE POLLUTION CONDITION SAMPLING STRATEGY.

	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	No more than 10% of sample can exceed (MPN/100 mL)	Geometric mean (MPN/100 mL)	No more than 10% of sample can exceed (MPN/100 mL)
Approved Water Classification	70	330	14	49
Special Restricted Water Classification	700	3300	88	300

TABLE 3: CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY.

	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	Estimated 90 th percentile (MPN/100 mL)	Geometric mean (MPN/100 mL)	Estimated 90 th percentile (MPN/100 mL)
Approved Water Classification	70	330	14	49
Special Restricted Water Classification	700	3300	88	300

SHORELINE SURVEY

CHANGES SINCE LAST SURVEY

The shoreline survey that was performed for this area on August 5, 2005 determined that there have been some minor changes made to the area bordering this shellfish growing area since the 2003 Partial Sanitary Survey of this shellfish growing area.

A new house was constructed along part of the eastern shoreline of Sunset Lake in Wildwood Crest (see Figure 11). Part of the upper edge of the bulkhead for this property also appeared to be rebuilt, and a new top platform and railing were also constructed for the dock.



FIGURE 11: LOCATION OF THE NEW HOUSE CONSTRUCTED ALONG PART OF THE EASTERN SHORELINE OF SUNSET LAKE IN WILDWOOD CREST.

LAND USE

An extensively urbanized area to the east and south and tidal wetlands to the north and west border much of this area. The urban areas to the east are resort areas (Wildwood, Wildwood Crest, and Cape May City) with significant boating and marine activities during the summer months (see Figure 12). There are currently 32 marinas in this area. The wetlands to the west of the growing area act as a buffer for the communities on the western side of the bay and west of the Garden State Parkway. However,

four small creeks (Taylor Creek, Jones Creek, Mill Creek, and Warren Creek) cross the Garden State Parkway and enter this shellfish growing area from these communities. Since some of these communities are still on septic systems, there is a potential for pollutant inputs into these shellfish growing waters. However, there is no evidence that they currently affect the water quality in this shellfish growing area.

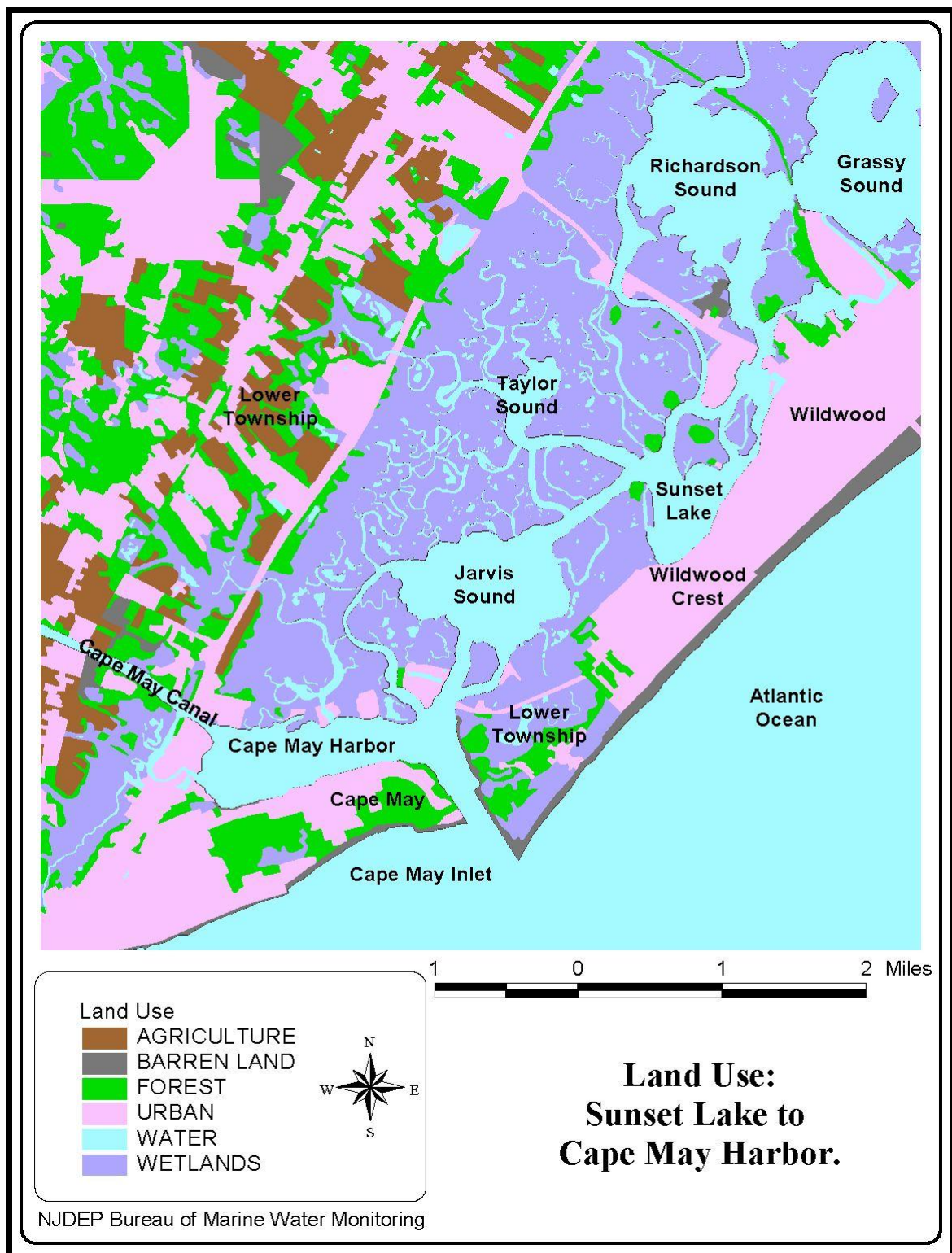


FIGURE 12: LAND USE PATTERNS FOR SHELLFISH GROWING AREA SE-7.

EVALUATION OF BIOLOGICAL RESOURCES

For 2000, the Port of Cape May - Wildwood harvested 59.5 million pounds of seafood products, with an exvessel value of \$28.6 million, placing the Port of Cape May - Wildwood at a ranking of 27th in the national commercial fisheries landing chart for dollar values (see Table 4). The 2003 fisheries landing totals for the Port of Cape May - Wildwood were 74.1 million pounds of seafood product for an exvessel value of \$42.8 million, placing the Port of Cape May - Wildwood at a ranking of 6th in the national commercial fisheries landings chart ranked by dollar values (see Table 4) (NMFS, 2005).

In 2000, New Jersey harvested 84,723,999 pounds of shellfish meat, with an exvessel value of \$75,087,167 (see Table 5). The 2003 shellfish landings total for New Jersey were 88,296,314 pounds of shellfish meat for an exvessel value of \$94,873,590 (see Table 5) (NJDEP, 2005, NMFS, 2005). These shellfish species include blue crabs (*Callinectes sapidus*), blue crabs – peelers, hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), mussels (Family: *Mytilidae*), bay scallops (*Aequipecten irradians*), oysters (*Crassostrea virginica*), ocean quahogs (*Arctica islandica*), surf clams (*Spisula solidissima*), and sea scallops (*Placopecten magellanicus*) (NJDEP, 2005, Morris, 1975, Gosner, 1978). However, this report primarily focuses on bivalve molluscan shellfish, not crustaceans.

TABLE 4: PORT OF CAPE MAY – WILDWOOD COMMERCIAL FISHERIES LANDINGS - 2000 TO 2003 (NMFS, 2005).

PORT OF CAPE MAY – WILDWOOD COMMERCIAL FISHERIES LANDINGS 2000 to 2003			
YEAR	POUNDS OF MEAT (millions)	\$ VALUE (exvessel) (millions of dollars)	U.S. PORT RANKED BY DOLLAR VALUE
2000	59.5	\$28.6	27
2001	66.5	\$33.1	17
2002	60.1	\$35.3	13
2003	74.1	\$42.8	6

TABLE 5: NEW JERSEY SHELLFISH LANDINGS - 2000 TO 2003 (NMFS, 2005).

NEW JERSEY SHELLFISH LANDINGS 2000 to 2003		
YEAR	POUNDS OF MEAT (millions)	\$ VALUE (exvessel)
2000	84,723,999	\$75,087,167
2001	88,611,198	\$83,523,782
2002	90,768,652	\$88,136,826
2003	88,296,314	\$94,873,590

Hard clams (*Mercenaria mercenaria*) exist in high densities and are privately and commercially harvested (Morris,

1975, Gosner, 1978). In New Jersey, for 2003, the shellfish landings for hard clams were 1,259,832 pounds harvested for an exvessel value of \$5,228,319 (NMFS, 2003). Blue crabs (*Callinectes sapidus*) are also harvested in this area.

Taylor Sound, Sunset Lake, Jarvis Sound, the Cape May Harbor, and the Cape May Inlet are also utilized for fishing, boating, and other marine activities. Many species of fish can be found in the waters of this shellfish growing area. The important fish species caught by marine recreational anglers are: Bluefish (*Pomatomus saltatrix*); Striped Bass (*Morone saxatilis*); Weakfish (*Cynoscion regalis*); Winter Flounder (*Pseudopleuronectes americanus*); Summer Flounder (Fluke) (*Paralichthys dentatus*); Tautog (*Tautoga onitis*); Scup (Porgy) (*Stenotomus chrysops*); Black Sea Bass (*Centropristus striata*); Northern Searobin (*Prionotus carolinus*); Northern Puffer (*Spheroideus maculatus*); Atlantic Silverside (*Menidia menidia*); and Mummichog (killies, minnows) (*Fundulus heteroclitus*) (The Richard Stockton College of New Jersey, 2002). In 1991, the Striped Bass (*Morone saxatilis*) was classified as a gamefish in New Jersey, and this status prevents the commercial harvest or sale of this first coastal saltwater species designated as such in New Jersey (Bochenek, 2000).

Many species of animals and vegetation can be found in the marshes of this shellfish growing area (see Figures 13 and 14). Wildlife populations (birds and animals) are actual contributors to water quality in Richardson Channel, Grassy Sound Channel, Taylor Sound, Swain Channel, Sunset Lake, Jarvis Sound, Upper Thorofare, Middle Thorofare, and Lower Thorofare. Large numbers of

gulls are usually observed feeding near the marinas at the east end of the Cape May Canal in Cape May Harbor (east side of the bridge going into Cape May). Birds sometimes may accumulate around the groins, jetties, seawalls, and bulkheads on the coast of this ocean shellfish growing area, and fecal matter from these birds could affect the water quality.

This shellfish growing area is almost completely surrounded by a shoreline of marshes, with areas of bulkheads, erodable shorelines, rock shorelines, and beaches composing the remainder of the shoreline. Bulkheads are located along the northeast shoreline of Sunset Lake (west of Wildwood Crest), along part of the south shoreline of Grassy Sound Channel, along the north shore of Shaw Cutoff, along part of the north shoreline of the Cape May Harbor, and along all of the west and south shorelines of the Cape May Harbor. Areas with an erodable shoreline include the southeast shoreline of Sunset Lake and part of the shoreline of Richardson Channel. Beaches and jetties border the Cape May Inlet area, and the Cape May Canal is bordered by a shoreline of rock (concrete walls).

This area also includes a wide variety of marsh types and vegetation, including vegetated salt marshes, tidal waters, non-wetlands, non-tidal ponds, sandy developed beaches, developed areas, and small areas of coastal scrub shrub. These marsh types and vegetation are located throughout the adjacent shoreline of this shellfish growing area. The north shoreline of the Cape May Inlet is sandy developed beaches and non-wetlands, while the south shoreline of the Cape May Inlet is sandy developed beaches and developed areas. Vegetated salt

marshes, tidal waters, non-wetlands, and non-tidal ponds primarily border Richardson Channel, Taylor Sound,

Swain Channel, Sunset Lake, Jarvis Sound, Upper Thorofare, Middle Thorofare, and Lower Thorofare.



FIGURE 13: OSPREY AND OSPREY NEST LOCATED IN THE MARSH TO THE SOUTH OF SWAIN CHANNEL. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 10:31 A.M.



FIGURE 14: BIRDS IN THE WATER ALONG THE WEST SHORE OF THE INTERCOASTAL WATERWAY, NORTH OF JARVIS SOUND. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 10:52 A.M.

IDENTIFICATION AND EVALUATION OF POTENTIAL POLLUTION SOURCES

There are several potential indirect ground water discharges, known contaminated sites, and solid waste landfills located in this shellfish growing area (see Figures 15, 16, and 17). However, there is no evidence that they currently impact the shellfish growing water quality in this area.

POTENTIAL INDIRECT DISCHARGES

There are several potential indirect ground water discharges located in this shellfish growing area (see Figure 15). The sources of the potential indirect ground water discharges into this shellfish growing area include the Rio Mall (Kmart Plaza), which is located to the northwest in Middle Township, the Cape May National Golf Club, which is located to the west in Lower Township, and the Shell Service Station, the Mobil Service Station (#15 EGW), and the City of Wildwood, which are located to the east in Wildwood.

This shellfish growing area, which extends from Sunset Lake to Cape May Harbor, has several known contaminated sites located in the adjacent areas (see Figure 16). The major concentrations of these known contaminated sites are located to the east in Wildwood and Wildwood Crest, to the northwest in Middle Township, and to the west in Lower Township. There are also a few known contaminated sites located to the south in Cape May. The primary causes of these known contaminated sites are

Since there is a potential for pollutant inputs from these indirect sources to get into these shellfish growing waters, it is important to continue monitoring the water quality of these areas to determine the presence or absence of these indirect sources of pollution.

from leaking underground storage tanks. Most of these known contaminated sites are now closed.

There are three solid waste landfills located adjacent to this shellfish growing area (see Figure 17). These landfills include the Filmore Construction Landfill, which is located in West Wildwood, the Wildwood Landfill, which is located in Wildwood, and the Lower Township Solid Waste Landfill, which is located in Lower Township. The Filmore Construction Landfill was closed in 1978, the Wildwood Landfill was closed in 1978, and the Lower Township Solid Waste Landfill was closed in 1979.

The potential indirect ground water discharges, the currently active known contaminated sites, and the closed solid waste landfills could have the potential to impact the water quality of this shellfish growing area. Therefore, the water quality in the Sunset Lake to Cape May Harbor area is constantly monitored to determine the presence or absence of these contaminants.

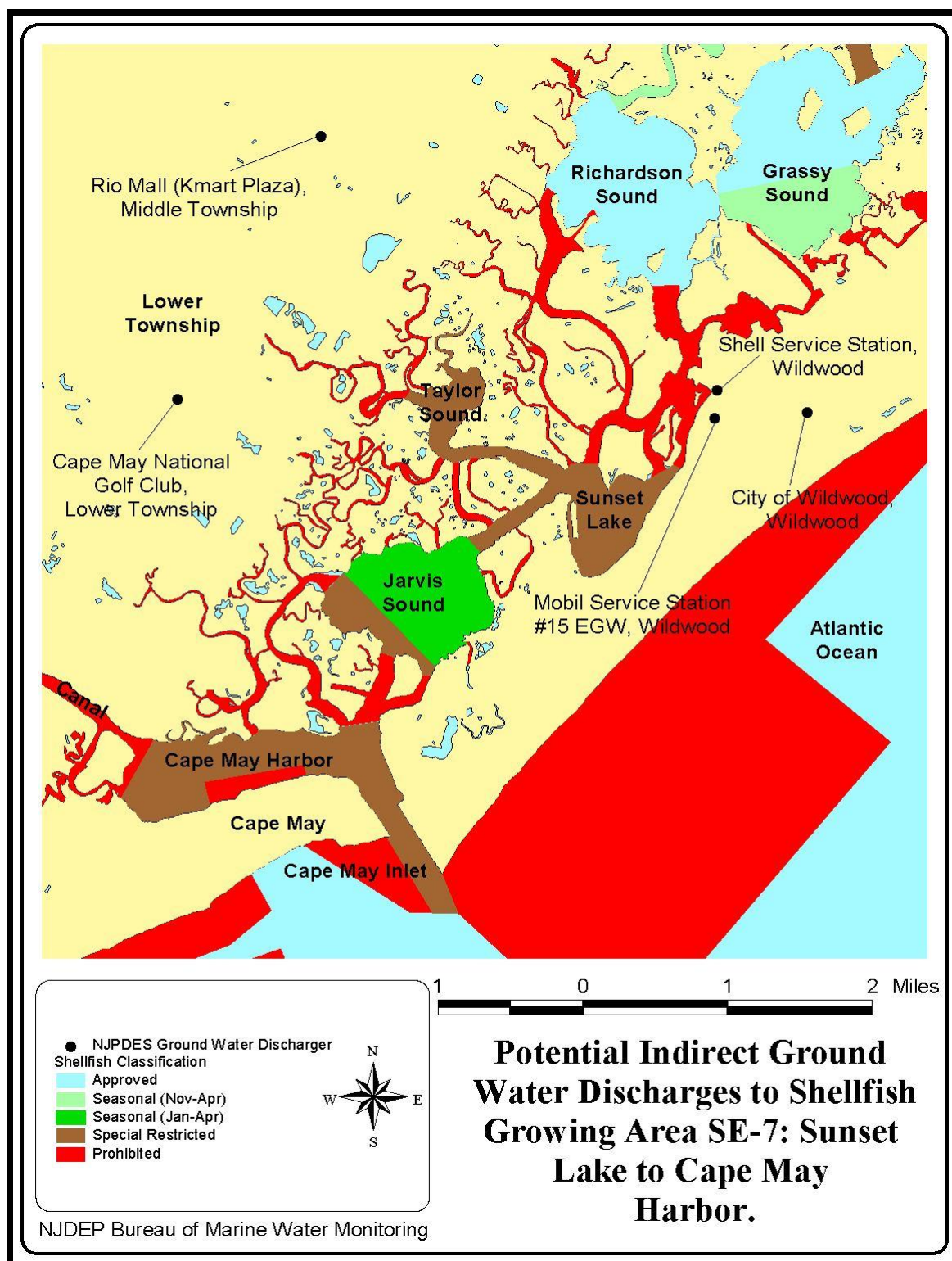


FIGURE 15: POTENTIAL INDIRECT GROUND WATER DISCHARGES TO THE WATERS OF SHELLFISH GROWING AREA SE-7.

Known Contaminated Sites in Shellfish Growing Area SE-7: Sunset Lake to Cape May Harbor

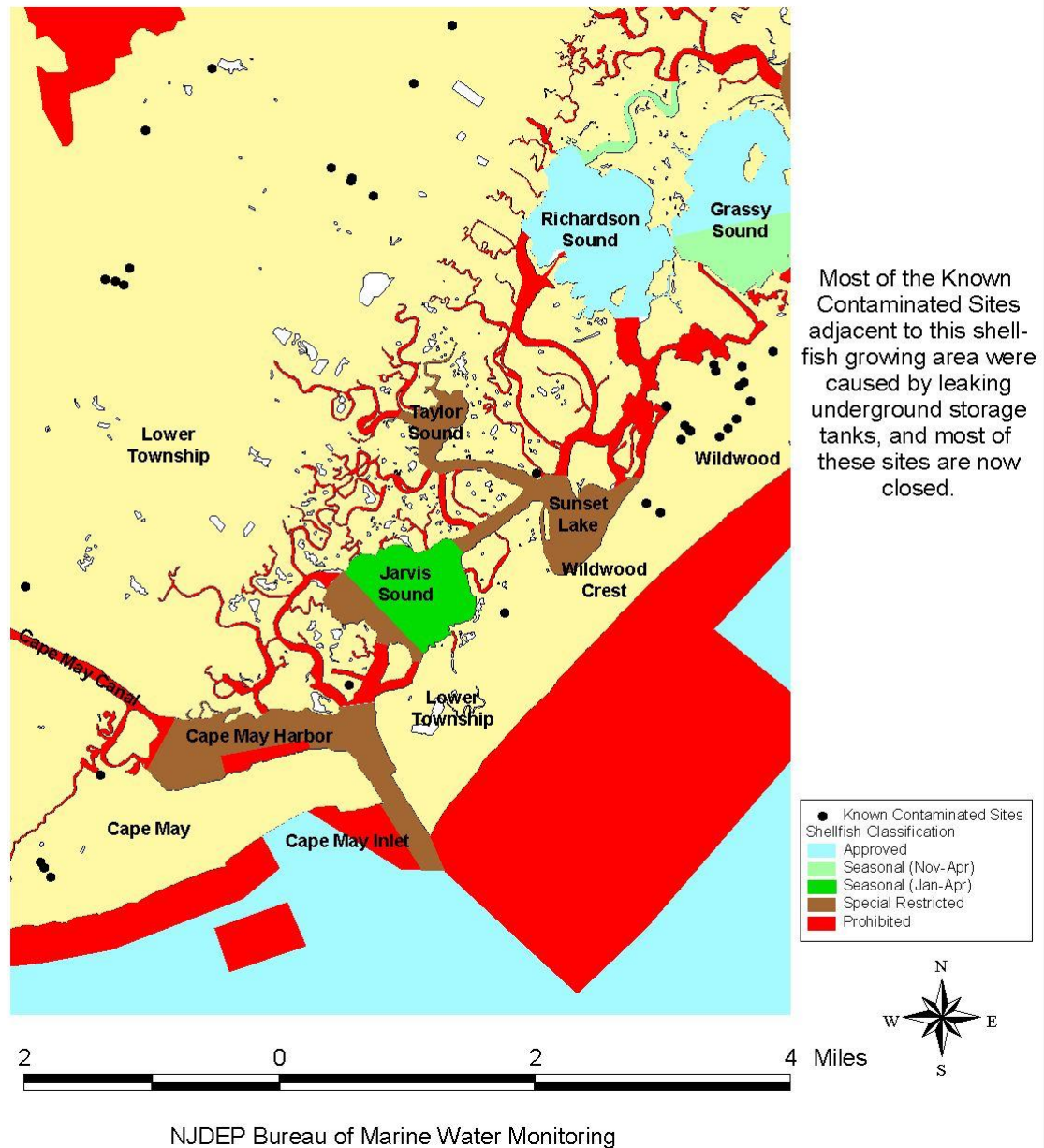


FIGURE 16: LOCATION OF KNOWN CONTAMINATED SITES ADJACENT TO SHELLFISH GROWING AREA SE-7.

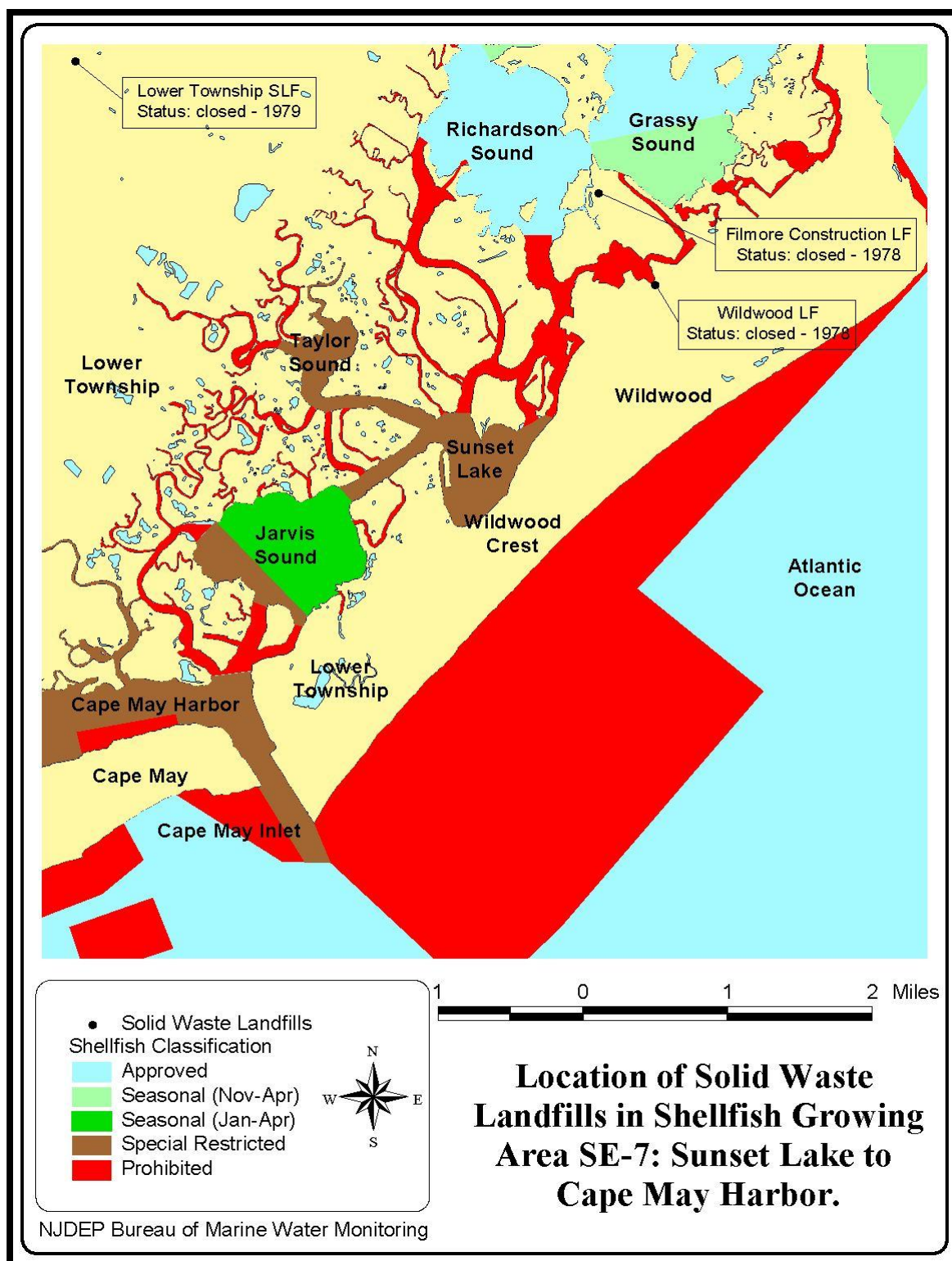


FIGURE 17: LOCATION OF SOLID WASTE LANDFILLS ADJACENT TO SHELLFISH GROWING AREA SE-7.

STORM WATER INPUT

The stormwater inputs to this shellfish growing area are the result of rainwater, which would normally be absorbed into vegetated soils and used to recharge aquifers, maintain stream base flow, and maintain waterway health, instead being collected on top of impervious surfaces, such as parking lots, rooftops, and roadways, and then temporarily collected in detention basins, and finally dumped into streams, creeks, wetlands, lakes, bays, and rivers. This runoff can carry a variety of waste materials, such as domestic and wild animal fecal materials, petroleum and other toxic

materials spilled from automobiles, and fertilizer and pesticide materials used on neighboring lots.

There are many stormwater outfalls located along the borders of this shellfish growing area. These stormwater outfalls mainly border Post Creek Basin, Grassy Sound Channel, Sunset Lake, Shell Thorofare, and Jarvis Sound (see Figures 18 and 19). There are also some storm water outfalls located to the west of this area in Lower Township near the Garden State Parkway and Route 9, and north of the Cape May Canal (see Figure 18).

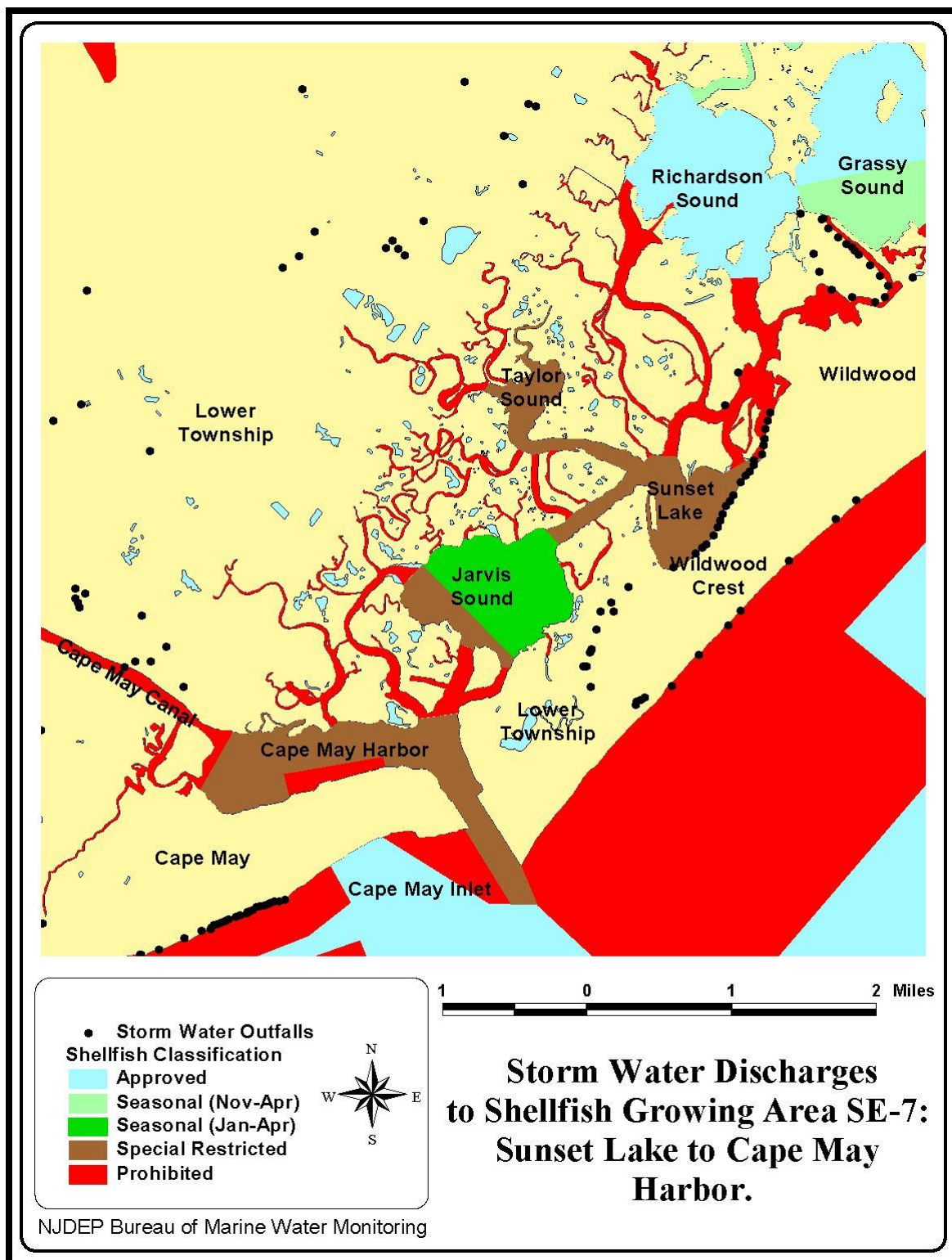


FIGURE 18: STORM WATER DISCHARGES TO SHELLFISH GROWING AREA SE-7.



FIGURE 19: LOCATION OF THE STORM WATER OUTFALL EXTENDING INTO SUNSET LAKE AT THE INTERSECTION OF FARRAGUT ROAD AND NEW JERSEY AVENUE IN WILDWOOD CREST. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 10:00 A.M.

MARINAS

Marina facilities have the potential to affect the suitability of shellfish growing areas for the harvest of shellfish. The biological and chemical contamination associated with marina facilities may be of public health significance. New Jersey defines a marina as "any structure (docks, piers, bulkheads, floating docks, etc.) that supports five or more boats, built on or near the water, which is utilized for docking, storing, or otherwise mooring vessels and usually but not necessarily provides services to

vessels such as repairing, fueling, security or other related activities.

It is recognized by the NSSP *Guide for the Control of Molluscan Shellfish* (USPHS, 1999 Revision) that there are significant regional differences in all factors that affect marina pollutant loading. The *NSSP Guide for the Control of Molluscan Shellfish*, therefore, allows each state latitude in applying specified occupancy and discharge rates. The NSSP guidelines assume the worst case scenario for each factor.

EQUATION 1: MARINA BUFFER EQUATION (ADAPTED FROM FDA, 1989):

$$BufferRadius(ft) = \sqrt{\frac{2 \times 10^9 (FC / person / day) \times 2 (person / boat) \times [(0.25 \times slips \geq 24') + (0.065 \times slips < 24')] \times 2}{140000 (FC / M^3) \times depth(ft) \times 0.3048 (M / ft) \times \pi \times 2 (tides / day)}} \times 3.28 (ft / M)$$

Explanation of terms in equation:

Fecal coliform per person per day:	2×10^9
Number of people per boat:	2
For slips able to accommodate boats > 24 feet (combination of factors yields multiplier of 0.25):	
Number of slips occupied:	50%
Number of boats occupied:	50%
For boats < 24':	6.5% discharge waste
Angle of shoreline:	180°, which results in factor of 2
Number of tides per day:	2
Depth in meters:	depth in feet x conversion factor
Water quality to be achieved:	140000 FC/meter ³
Convert meters to feet:	3.28

Marina buffer zones may be calculated using the formula above (see Equation 1), or may be determined using a dilution analysis computer program developed by the State of Virginia and the USFDA. The formula above considers only dilution and occupancy rates. The computer program, which is used for complex configurations where the formula is unlikely to provide the needed accuracy, also considers tidal exchange and bacterial die-off.

There are 32 marinas in area SE-7, as shown in Table 6, and Figures 20 and 21. The waters enclosed by the marina (the marina basin) are classified as

Prohibited. Depending on the size of the marina, the water quality, flushing rates, and the depth of the water, shellfish waters immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, or *Seasonally Approved* (no harvest during summer months when the marina is normally active). Marina buffer zones for this shellfish growing area were calculated using the New Jersey Marina Buffer Equation (see Equation 1). The size of each buffer zone is shown in Table 6. Figures 22, 23, and 24, show three of the marinas located in this shellfish growing area.

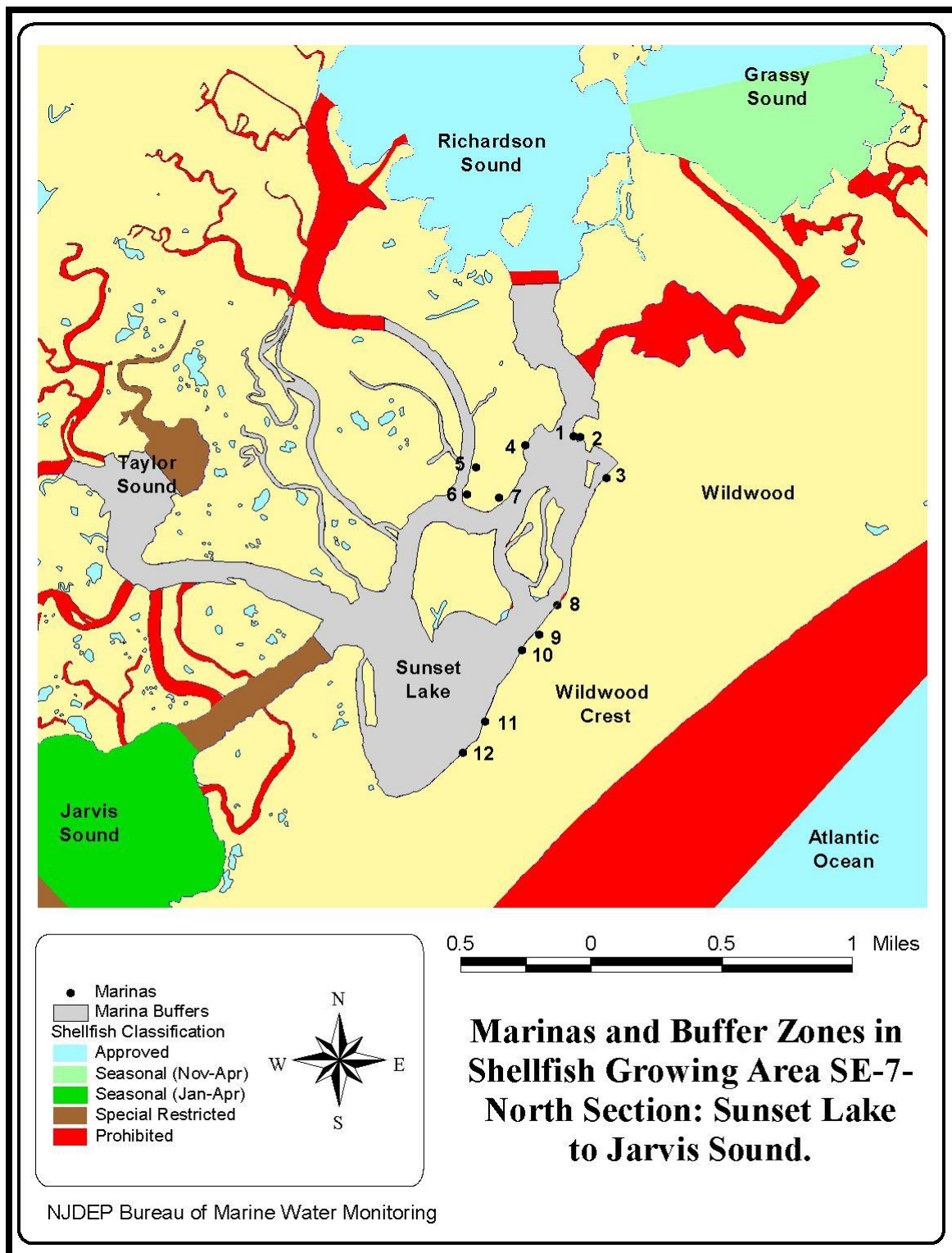


FIGURE 20: MARINA FACILITIES LOCATED IN SHELLFISH GROWING AREA SE-7 – NORTH SECTION: SUNSET LAKE TO JARVIS SOUND.

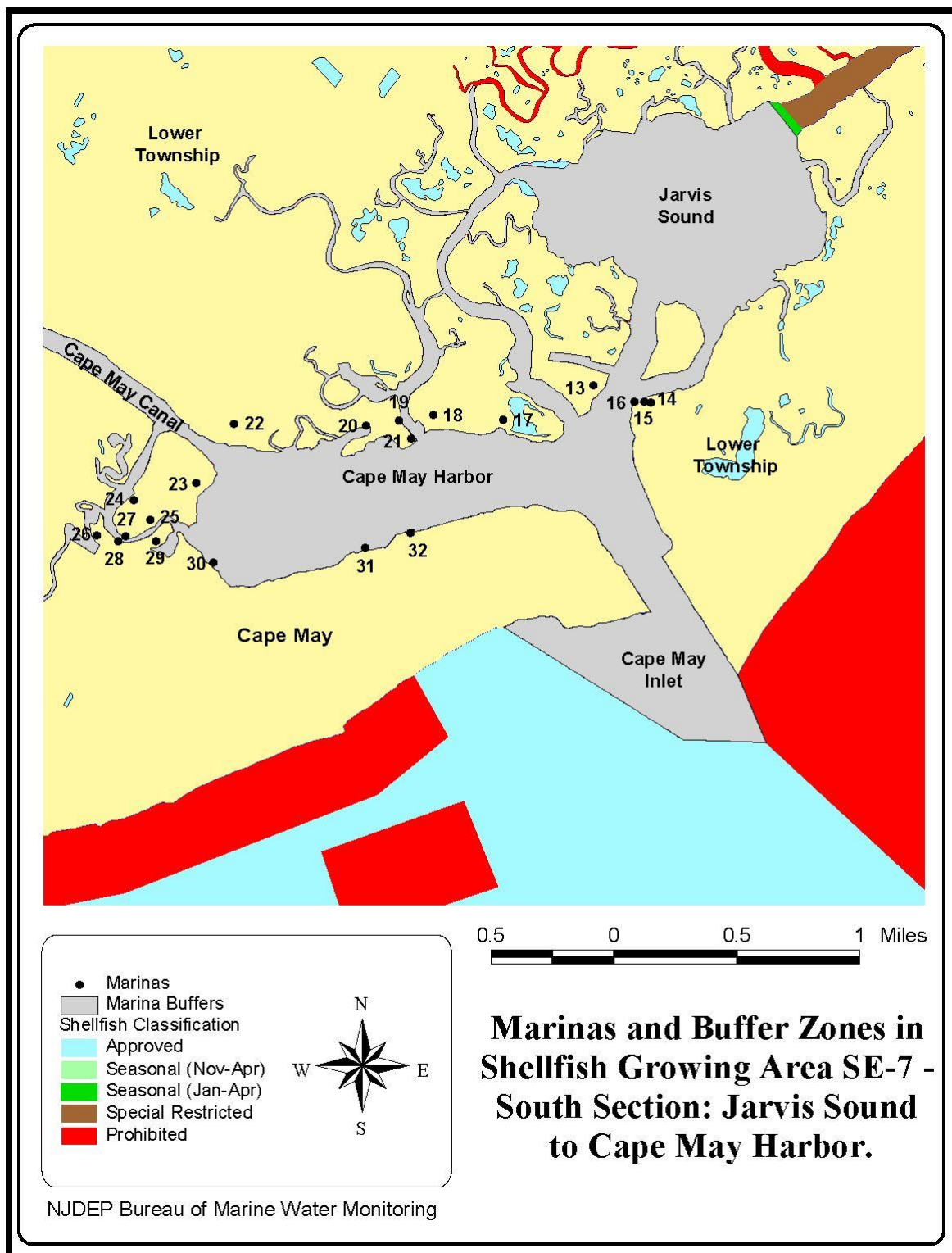


FIGURE 21 : MARINA FACILITIES LOCATED IN SHELLFISH GROWING AREA SE-7 – SOUTH SECTION: JARVIS SOUND TO CAPE MAY HARBOR.

TABLE 6: MARINA FACILITIES LOCATED IN SHELLFISH GROWING AREA SE-7.

Map Key	Marina Name	Location	# of Wet Slips Total/Boats > 24ft.	Size of Buffer Area (radius; feet)	Average Water Depth (ft)
1	Mocean Water Sports	Wildwood	12/12	347	8
2	Sea Raider Charter	Wildwood	7/7	265	8
3	Schooner Island Marina	Wildwood	310/310	2231	5
4	Lighthouse Point Marina	Wildwood	165/165	1010	13
5	Shawcrest Marina I	Lower Township	36/36	471	13
6	Shawcrest Marina II	Lower Township	89/75	697	13
7	Starcrest Marina	Wildwood	10/1	211	6
8	Royal Flush Fleet	Wildwood Crest	3/3	174	8
9	Captain Sinns Marina	Wildwood Crest	3/3	174	8
10	Greater Wildwood Yacht	Wildwood Crest	7/0	144	7
11	Lake View Docks	Wildwood Crest	4/0	102	8
12	Greater Wildwood Yacht	Wildwood Crest	20/0	215	9
13	Hinch's Marina	Lower Township	110/110	1051	8
14	Two Mile Landing Marina	Lower Township	64/64	585	15
15	Two Mile Landing (Co.)	Lower Township	5/5	164	15
16	Cape Harbor Yacht Club	Lower Township	25/25	366	15
17	Breezee Lee Yacht Club	Lower Township	450/200	2062	5
18	Mill Creek Marina	Lower Township	100/100	1636	3
19	McDuell's Marina	Lower Township	30/14	854	2
20	Snug Harbor Marina (was Cedar Creek Marina)	Lower Township	65/30	1253	2
21	Harbor View Marina	Lower Township	25/20	654	4
22	Canyon Club Resort Mar.	Lower Township	257/211	1410	9
23	Utsch's Marina	Lower Township	300/250	1531	9
24	Miss Chris Fishing Center	Lower Township	11/11	420	5
25	South Jersey Marina	Lower Township	66/66	1151	4
26	Cape May Marine	Cape May	165/140	1534	5
27	Roseman's Boat Yard	Cape May	20/5	423	4

Map Key	Marina Name	Location	# of Wet Slips Total/Boats > 24ft.	Size of Buffer Area (radius; feet)	Depth (ft)
28	Cape May Marina	Cape May	210/210	1552	7
29	Yacht Lodge Marina	Cape May	12/12	371	7
30	Harbor Village & Yacht	Cape May	26/26	590	6
31	Corinthian Yacht Club	Cape May	18/18	538	5
32	U.S. Coast Guard	Cape May	8/8	200	16

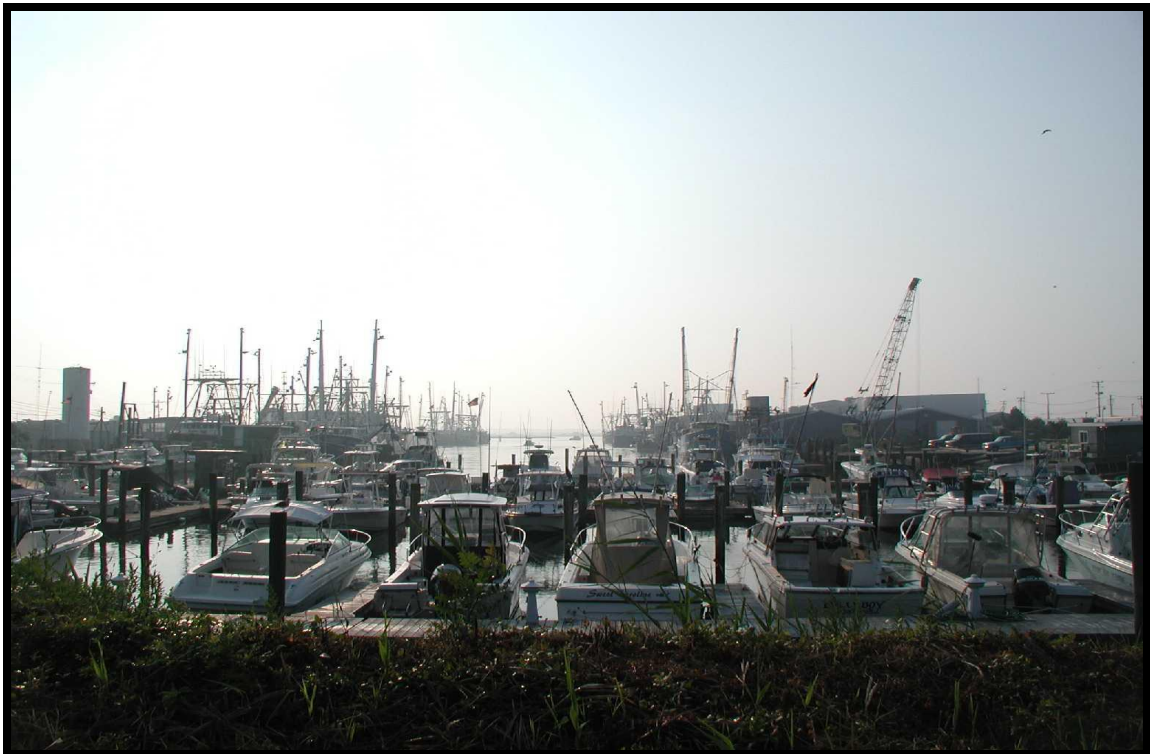


FIGURE 22: LOCATION OF HINCH'S MARINA, NORTH OF THE CAPE MAY HARBOR. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 7:54 A.M.



FIGURE 23: LOCATION OF HARBOR VIEW MARINA IN THE CAPE MAY HARBOR. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 8:48 A.M.



FIGURE 24: LOCATION OF THE EAST DOCK AT THE U.S. COAST GUARD RECEIVING CENTER, SOUTH OF THE CAPE MAY HARBOR. PHOTOGRAPH WAS TAKEN ON AUGUST 5, 2005 AT 9:16 A.M.

SPILLS OR OTHER UNPERMITTED DISCHARGES

On September 4, 2003, a sewage spill was reported at the intersection of Route 47 and the exit ramp of the Garden State Parkway in Rio Grande, Middle Township. At this location, a tanker truck had flipped over on its side on Route 47 and spilled 4,000 gallons of raw sewage onto the roadway, the center median, and along the south shoulder of the road (see Figures 25 and 26). The raw sewage was reported to have spilled into the two stormwater drains along the south shoulder of Route 47 and eventually discharged into the wetlands along the south side of the road. Carino Creek is located within the wetlands to the south of Route 47 at this location, and Carino Creek eventually flows into Richardson Channel. The waters of Carino Creek and Richardson Channel are classified as *Prohibited* to shellfish harvesting. The clean up of the sewage spill was begun immediately by Wildwood Crest, the West Cape May Hazardous Materials Team, the Cape May County MUA, and the Middle Township Fire & Rescue squads. The clean up of the sewage spill consisted of hosing and sweeping the street, while the water and sewage remaining on the ground was diverted to three vacuum trucks and removed. Sandbags were placed around the two stormwater drains to act as berms. A crew from Russell Reid Wastewater Management also arrived on site to assist in the clean up of the sewage spill by raking and vacuuming up the sewage from the road surface, the shoulder of the road, and the road median. They also spread lime onto the roadway, on the shoulder of the road,

and in the center median for disinfection. The sewage spill was reported as being completely cleaned up by 8:00 A.M. on September 5, 2003.

On April 10, 2002, a sewage spill was reported for the area of Rio Grande Avenue and Hudson Avenue in Wildwood. According to the report received by the Bureau of Marine Water Monitoring, approximately 2,000 gallons of raw sewage leaked into the intersection of these roads from a blocked sewer line. The southern part of Grassy Sound Channel is located about 600 yards away from the spill, and the shellfish classification for this section of Grassy Sound Channel is *Prohibited* to shellfish harvesting. However, this sewage spill was reported as terminated and the cleanup of the area was completed at the time this report was received.

On August 5, 2001, a sewage spill was reported for 500 West Rio Grande Avenue in Wildwood, near the intersection of West Rio Grande Avenue and Hudson Avenue. According to the report received by the Bureau of Marine Water Monitoring, approximately 2,000 gallons of raw sewage leaked from a sewer line blocked with grease. The southern part of Grassy Sound Channel is located about 600 yards away from the spill, and the shellfish classification for this section of Grassy Sound Channel is *Prohibited* to shellfish harvesting. However, this sewage spill was reported as being cleaned up at the time this report was received. The Cape May

County Health Department was notified of this sewage spill.

period from October 2001 to September 2005.

There were no emergency closures of shellfish waters occurring in this shellfish growing area for the time



FIGURE 25: THE CLEANUP OF THE SEWAGE SPILL ON THE SOUTH LANE OF ROUTE 47, EAST OF THE GARDEN STATE PARKWAY, IN RIO GRANDE, MIDDLE TOWNSHIP, CAPE MAY COUNTY. PHOTOGRAPH WAS TAKEN ON SEPTEMBER 4, 2003 AT 4:30 P.M.



FIGURE 26: THE SEWAGE SPILL ON THE SOUTH SHOULDER OF ROUTE 47, EAST OF THE GARDEN STATE PARKWAY, IN RIO GRANDE, MIDDLE TOWNSHIP, CAPE MAY COUNTY. PHOTOGRAPH WAS TAKEN ON SEPTEMBER 4, 2003 AT 4:48 P.M.

HYDROLOGY AND METEOROLOGY

PATTERNS OF PRECIPITATION

Precipitation patterns in the coastal areas of New Jersey are typical of the Mid-Atlantic coastal region (see Table 7). Typical summer storms are

localized storms associated with thunderstorms. Winter storms are frequently associated with northeasters. Hurricanes can occur during the summer and early fall.

TABLE 7: AVERAGE MID-ATLANTIC STORM EVENT INFORMATION (SOURCES: USEPA; US DEPARTMENT OF COMMERCE).

Annual Average Number of Storms	60
Average Storm Event Duration	10 hours
Average Storm Event Intensity	0.08 – 0.09 inches/hour
Average Storm Event Volume	0.65 inches

Although the average storm event lasts approximately 10 hours, with an accumulation of 0.65 inches, it is not unusual for an individual storm volume to be 2 – 3 inches. Note the data below that show the 2-year return

6-hour storm event to be between two and three in inches, while the 2-year 24-hour return volume varies between three and four inches (see Table 8). Storm volumes greater than approximately 3.5 – 4.0 inches are much less frequent.

TABLE 8: STORM EVENT VOLUME FOR 2-YEAR STORM EVENT RECURRENCE (SOURCE: USGS).

Location	2-Year, 1-Hour Rainfall	2-Year, 6-Hour Rainfall	2-Year, 24-Hour Rainfall
Millville	1.33	2.33	3.02
Cape May	1.33	2.41	3.10
Atlantic City	1.47	2.67	3.65
Long Branch	1.55	3.02	4.15
Newark	1.21	2.34	3.25
Sandy Hook	1.37	2.73	3.68

HYDROLOGY

An extensively developed urban area to the south and east and tidal marshes to the north and west border this shellfish growing area. The five main bodies of water in this area are Taylor Sound, Sunset Lake, Jarvis Sound, the Cape May Canal, and the Cape May Harbor. The back bays in this area typically have depths ranging from 1 to 23 feet MLW (Mean Low Water). The depth of the water in Middle Thorofare and the Intercoastal Waterway average about 15 to 20 feet MLW (Mean Low Water). There is a mean range of 4.4 feet for the tides in this area. The tidal cycle is diurnal, with two high tides and two low tides in a 24 hour, 50 minute period. The tides around the Atlantic Ocean occur twice a day (two high and two low) and have essentially the same range, or vertical distance from high to low water (Ingmanson and Wallace, 1989). Tidal flushing in this area is mainly through the Cape May Inlet, with some tidal flushing through the Cape May Canal (USDI-GS, Photorevised 1972-Wildwood, and USDI-GS, Photorevised 1972-Cape May).

This shellfish growing area was sampled with no tidal preference for Assignment Area 277 (Shellfish Growing Area SE-

7). Ebb and flood tides describe the horizontal motions associated with the fall and rise of the tide in restricted regions along the coast. Tidal currents can affect the water quality of a shellfish growing area, because hydrographic and meteorological characteristics, such as tidal amplitude and type, water circulation patterns, depth, salinity, stratification characteristics, rainfall patterns and intensity, and prevailing winds, may affect the distribution of pollutants in a specific area (Ingmanson and Wallace, 1989). This is why an evaluation of pollution sources and hydrographic characteristics are used to evaluate the water quality in a shellfish growing area.

Precipitation inputs to this area for the period 2000 through 2005 are shown in Table 9. There have been no significant changes in hydrography since the last sanitary survey report was written in 2003. The primary weather station for this area is Cape May. The secondary weather station for this area is the Millville Airport. The secondary station data are used when data from the primary station are incomplete.

TABLE 9: CLIMATOLOGICAL DATA.

Rainfall Recorded at NOAA's Cape May Station

Sampling Date	Precipitation in Inches		
	Day of Sampling	1 day prior	2 days prior
10/23/2000	0.000	0.000	0.000
02/15/2001	0.060	0.070	0.210
02/27/2001	0.000	0.000	0.180
03/09/2001	0.170	0.170	0.170
03/19/2001	0.000	0.000	0.060
04/25/2001	0.140	0.280	0.280
06/06/2001	0.005	0.195	0.195
07/10/2001	0.020	0.020	0.020
07/25/2001	0.000	0.000	0.000
08/06/2001	0.000	0.000	0.000
08/20/2001	0.000	0.005	0.915
09/19/2001	0.000	0.000	0.000
10/02/2001	0.000	0.550	1.510
12/04/2001	0.000	0.000	0.000
01/14/2002	0.030	0.310	0.310
02/28/2002	0.000	0.060	0.060
03/11/2002	0.000	0.020	0.050
04/11/2002	0.000	0.330	0.335
06/11/2002	0.000	0.000	0.000
07/09/2002	0.000	0.000	0.000
07/23/2002	0.030	0.030	0.030
09/24/2002	0.000	0.000	0.000
06/02/2003	0.000	0.030	0.200
07/15/2003	0.000	0.720	0.720
07/30/2003	0.880	1.440	1.790
08/13/2003	0.000	0.030	0.050
08/19/2003	0.000	0.000	0.150
09/05/2003	0.000	0.790	0.830
09/15/2003	0.210	0.590	0.720
10/22/2003	0.020	0.020	0.020
12/18/2003	0.000	0.450	0.450
03/24/2004	0.000	0.000	0.000
04/23/2004	0.220	0.220	0.220
07/07/2004	0.000	0.000	0.010
07/15/2004	0.000	0.138	0.138
07/20/2004	0.000	0.010	0.390
08/13/2004	0.310	0.310	0.310

WATER QUALITY STUDIES

BACTERIOLOGICAL QUALITY

The statistical summary for this area (sampled according to the SRS sampling strategy) is listed in Table 10. This shellfish growing area is composed of one assignment area, Assignment 277 (Jarvis Sound and Cape May Harbor), and is sampled using Systematic Random Sampling (SRS) strategy year-round. Figure 10 shows all of the 47 sampling stations in this shellfish growing area. The raw data listings for

each sampling station in accordance with the National Shellfish Sanitation Program (NSSP) criteria are given at the end of this report in the Appendix. There were no stations that exceeded the NSSP shellfish classification criteria for water quality in the *Seasonally Approved* (January to April), *Special Restricted*, and *Prohibited* areas of this shellfish growing area.

TABLE 10: WATER QUALITY SUMMARY :SRS STATIONS (10/1/2000 - 9/30/2005).

Station	Status	Year Round			Summer			Winter		
		Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N
3600D	P	11.4	68.3	41	18.0	114.9	25	5.6	19.9	16
3601	P	18.6	124.1	41	37.2	237.2	25	6.3	15.0	16
3601A	P	10.5	61.8	41	17.8	110.2	25	4.6	13.1	16
3601B	P	12.0	59.6	41	17.2	83.8	25	6.8	27.3	16
3601C	P	11.6	76.0	41	21.5	137.2	25	4.4	13.5	16
3601E	P	11.0	57.2	41	19.1	103.2	25	4.6	9.8	16
3602	SR	11.2	64.5	41	19.3	116.5	25	4.8	12.7	16
3602B	SR	13.4	82.8	41	22.6	158.9	25	5.9	14.8	16
3602C	SR	11.9	69.9	41	17.4	94.1	25	6.6	35.2	16
3602D	SR	9.5	56.6	41	15.8	111.9	25	4.3	9.0	16
3602E	SR	11.4	67.4	41	17.2	109.1	25	5.9	22.6	16
3602F	SR	10.9	68.1	41	19.3	129.3	25	4.5	11.4	16
3602G	SR	14.6	145.0	41	31.5	347.1	25	4.4	10.2	16
3602H	SR	11.9	103.6	41	20.7	241.6	25	5.0	11.5	16
3602I	SR	11.2	82.1	41	16.9	156.9	25	5.8	19.7	16
3602J	SR	9.5	66.9	41	16.5	143.5	25	4.0	8.4	16
3604A	SR	12.6	97.9	41	24.2	215.9	25	4.6	9.7	16
3604E	SR	13.3	85.8	41	22.9	159.0	25	5.6	16.9	16
3605C	SR	13.0	88.3	41	21.1	162.9	25	6.1	20.5	16
3606A	SR	10.9	78.8	41	16.2	153.0	25	5.8	18.0	16
3607A	SJ	10.2	63.5	41	18.0	125.5	25	4.2	9.2	16
3608	SJ	9.4	52.6	40	11.7	67.6	25	6.6	33.0	15
3608A	SJ	6.3	28.2	41	7.9	47.5	25	4.4	8.9	16
3608B	SJ	7.8	45.3	40	11.2	80.0	25	4.3	11.4	15
3608C	SJ	10.8	58.1	40	16.5	91.6	25	5.3	17.6	15

Station	Status	Year Round			Summer			Winter		
		Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N
3608D	SJ	7.8	45.6	39	9.3	65.2	24	5.8	24.2	15
3608E	SJ	7.4	41.4	41	11.0	78.7	25	3.9	8.6	16
3608G	SR	8.7	53.9	40	9.5	58.8	25	7.4	48.7	15
3608H	SR	9.5	71.8	41	14.7	140.7	25	4.8	15.7	16
3608I	SR	7.1	41.7	41	9.1	47.8	25	4.9	31.8	16
3612A	P	8.5	48.9	41	11.8	69.3	25	5.0	23.8	16
3612B	P	41.2	883.5	41	58.4	1477.5	25	23.8	369.7	16
3612C	P	14.8	179.3	41	36.3	478.6	25	3.6	6.4	16
3613A	SR	7.6	32.6	40	8.1	34.0	24	6.8	31.6	16
3614	P	7.3	44.8	41	8.4	60.2	25	5.9	27.8	16
3614A	SR	7.7	47.0	41	10.3	70.1	25	4.9	21.9	16
3615	P	5.9	22.2	41	6.3	30.4	25	5.4	12.1	16
3615A	SR	6.2	29.5	40	8.0	51.7	24	4.3	9.0	16
3616	SR	9.1	51.1	40	12.4	84.2	24	5.7	19.5	16
3616A	SR	7.7	35.8	41	11.2	60.3	25	4.4	10.5	16
3616B	SR	6.0	25.1	41	6.4	27.5	25	5.3	22.5	16
3616C	SR	16.6	127.3	41	25.4	222.5	25	8.5	38.4	16
3616E	SR	13.7	98.1	41	22.7	199.5	25	6.2	16.8	16
3616F	SR	7.9	39.8	41	10.7	61.5	25	5.0	16.4	16
3617A	SR	15.8	126.9	41	22.0	207.5	25	9.4	49.4	16
3617B	SR	24.3	203.2	41	40.5	416.6	25	10.9	37.4	16
3618D	P	56.7	644.5	41	66.1	819.7	25	44.6	460.4	16

TIDAL EFFECTS.

Tidal impacts were evaluated by performing a t-test on log-transformed total coliform MPN values. Table 11 lists the sampling station in this shellfish growing area that shows a relationship between

tidal effects and water quality. Figure 27 shows the location of this sampling station. This shellfish growing area was not sampled with a tidal preference for the Sunset Lake to Cape May Harbor area.

TABLE 11: TIDAL EFFECTS.

Station	Total Coliform Geometric Mean MPN		Probability>[T]	Location	Classification
	Ebb	Flood			
3618D	90.4	27.3	0.048	Schellenger Creek, west of Cape May Harbor	<i>Prohibited</i>

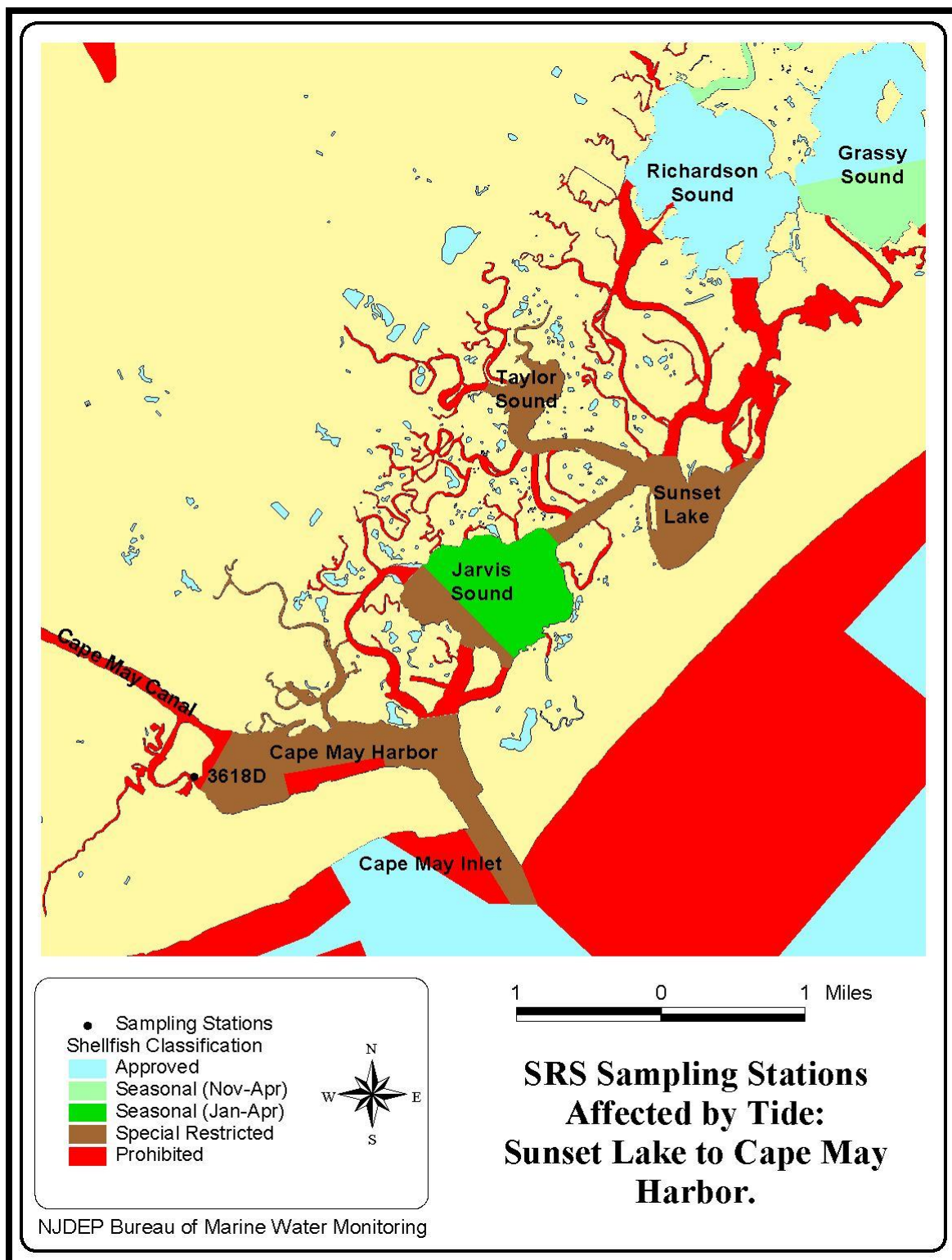


FIGURE 27: SAMPLING STATIONS AFFECTED BY TIDE.

RAINFALL EFFECTS

Non-point source pressures on shellfish beds in New Jersey originate in materials that enter the water via stormwater. These materials include bacteria, as well as other waste that enters the stormwater collection system.

Rainfall impacts were assessed by using a t-test to compare the total coliform MPN values from water samples collected during wet weather to water samples collected during dry weather for the 10 years from 10/1/1995 to 9/30/2005. The Wet/Dry Statistics were calculated based on a post impact time of 48 hours prior to the day of sampling and a wet/dry cutoff of 0.3 inches of rain. Any rainfall amounts above 0.3 inches are considered to be a wet condition. A sampling station is considered to be impacted by rainfall when the t-statistic

probability is 0.05 or less, but not zero. Using these parameters for the rainfall data, 11 sampling stations showed an impact from rainfall for this shellfish growing area during the ten years from 10/1/1995 to 9/30/2005 (see Table 12 and Figure 28).

The Bureau of Marine Water Monitoring has begun to identify particular stormwater outfalls that discharge excessive bacteriological loads during storm events. In some cases, specific discharge points can be identified. When specific outfalls are identified as significant sources, the Department works with the county and municipality to further refine the source(s) of the contamination and implement remediation activities.

TABLE 12: STATIONS IMPACTED BY RAINFALL (10/1/1995 - 9/30/2005).

Station	Status	t-Statistic Probability	Wet Count	Wet Geo Mean	Dry Count	Dry Geo Mean	Wet/Dry Difference
3601A	<i>Prohibited</i>	0.031	20	44.7	55	16.4	-28
3601C	<i>Prohibited</i>	0.007	20	54.4	55	14.9	-39
3602I	<i>Special Restricted</i>	0.042	20	42.1	55	15.9	-26
3608	<i>Seasonal (Jan. – Apr)</i>	0.048	21	29.9	55	12.8	-17
3608C	<i>Seasonal (Jan. – Apr)</i>	0.012	21	36.1	55	13.1	-23
3608E	<i>Seasonal (Jan. – Apr)</i>	0.043	22	34.1	57	13.5	-21
3615	<i>Prohibited</i>	0.019	20	14.9	55	6.7	-8
3616A	<i>Special Restricted</i>	0.026	20	16.7	55	7.7	-9
3616B	<i>Special Restricted</i>	0.037	20	14.3	55	6.8	-7
3617A	<i>Special Restricted</i>	0.031	20	43.1	55	16.4	-27
3617B	<i>Special Restricted</i>	0.004	20	102.4	55	26.8	-76

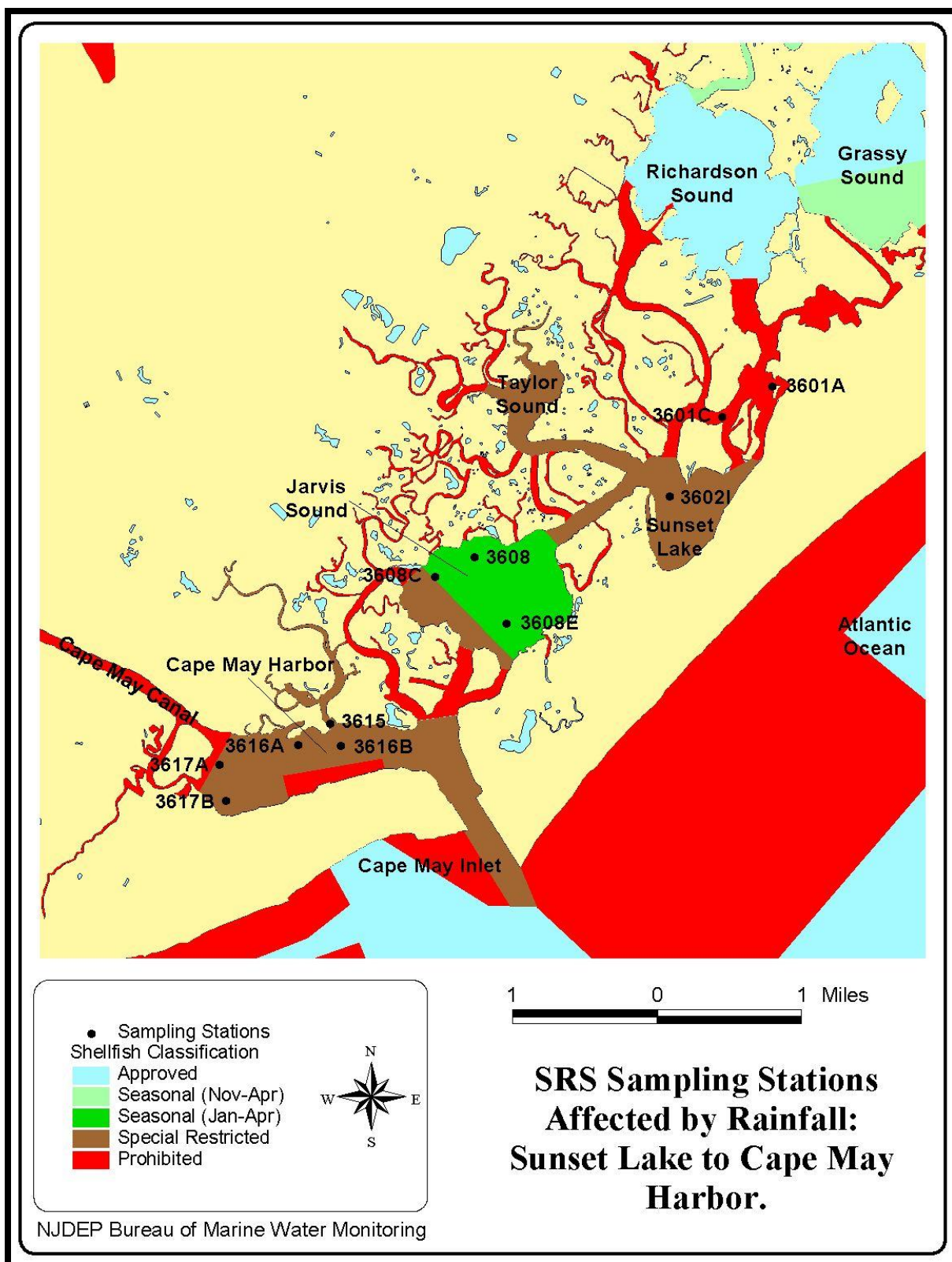


FIGURE 28: SAMPLING STATIONS AFFECTED BY RAINFALL.

SEASONAL EFFECTS.

In the hydrologic cycle, the motion of all water is controlled by the sun's energy, tides, the motion of the earth, and the differing densities of water masses. The basic component of the hydrologic cycle is the energy of the sun, which moves water by evaporation, convection, and precipitation. As the earth experiences variations in the tilt of its axis and its revolution around the sun, it goes through seasonal phases of summer, spring, autumn, and winter. These seasonal phases have much variation on the atmosphere of the earth, causing changes in weather patterns. Since the atmosphere and the hydrosphere are intimately related, any variation to the atmosphere has an effect on the hydrosphere. Temperature, precipitation, wind, and the general circulation of the atmosphere have seasonal variations that also affect the marine environment.

Shellfish are filter feeding organisms that live in the sand, silt, and mud on the bottom of oceans and bays. They have a range of tolerance to specific environmental conditions, such as temperatures, salinity levels, oxygen levels, quantity and availability of food, and water quality. Seasonal effects on these variables will have an effect on shellfish populations. For example, different species of shellfish require very specific salinity levels for

survival. Since salinity levels can have an effect on the species found in certain waters of an area, the salinity level is important for a complete understanding of the complex ecological balance in the marine environment. At a time of the year when rainfall is low, where evaporation exceeds precipitation, the salinity of the marine environment in certain areas is higher than it is in regions where precipitation exceeds evaporation. This can affect the quantity and type of shellfish found in a specific area.

Seasonal variations also affect human activities, with generally more human activity in the warmer months of the year. An increase in human activities in or near the marine environment can have an impact on shellfish populations. Increased pressure from human activities on already stressed failing septic systems and overloaded wastewater treatment facilities can cause sewage to spill into the marine environment, which can negatively impact the water quality of a shellfish growing area by increasing the coliform levels in the water.

Seasonal effects were assessed using a t-test to compare log-transformed total coliform values for summer versus winter data. Table 13 lists the sampling stations in this shellfish growing area that showed a correlation between seasonal effects and water quality. Figure 29 shows the locations of these sampling stations.

TABLE 13: SEASONAL EFFECTS.

Station	Total Coliform Geometric Mean MPN		Probability>[T]	Location	Classification
	Summer	Winter			
3600D	18.0	5.6	0.008	Richardson Channel	<i>Prohibited</i>
3601A	17.8	4.6	0.001	Grassy Sound Channel	<i>Prohibited</i>
3601B	17.2	6.8	0.018	Grassy Sound Channel	<i>Prohibited</i>
3602	19.3	4.8	0.001	Sunset Lake	<i>Special Restricted</i>
3602B	22.6	5.9	0.002	Sunset Lake	<i>Special Restricted</i>
3602C	17.4	6.6	0.027	Sunset Lake	<i>Special Restricted</i>
3602D	15.8	4.3	0.002	Sunset Lake	<i>Special Restricted</i>
3602E	17.2	5.9	0.015	Sunset Lake	<i>Special Restricted</i>
3602F	19.3	4.5	0.001	Sunset Lake	<i>Special Restricted</i>
3602H	20.7	5.0	0.007	Sunset Lake	<i>Special Restricted</i>
3602I	16.9	5.8	0.031	Sunset Lake	<i>Special Restricted</i>
3602J	16.5	4.0	0.003	Sunset Lake	<i>Special Restricted</i>
3604A	24.2	4.6	0.001	Taylor Sound	<i>Special Restricted</i>
3604E	22.9	5.6	0.002	Swain Channel	<i>Special Restricted</i>
3605C	21.1	6.1	0.008	Intracoastal Waterway	<i>Special Restricted</i>
3606A	16.2	5.8	0.036	Intracoastal Waterway	<i>Special Restricted</i>
3607A	18.0	4.2	0.001	Jarvis Sound	<i>Seasonal (Jan. – Apr)</i>
3608B	11.2	4.3	0.030	Jarvis Sound	<i>Seasonal (Jan. – Apr)</i>
3608C	16.5	5.3	0.006	Jarvis Sound	<i>Seasonal (Jan. – Apr)</i>
3608E	11.0	3.9	0.014	Jarvis Sound	<i>Seasonal (Jan. – Apr)</i>
3608H	14.7	4.8	0.024	Jarvis Sound	<i>Special Restricted</i>
3612A	11.8	5.0	0.048	Middle Thorofare	<i>Prohibited</i>
3616A	11.2	4.4	0.013	Cape May Harbor	<i>Special Restricted</i>
3616C	25.4	8.5	0.029	Cape May Harbor	<i>Special Restricted</i>
3616E	22.7	6.2	0.007	Cape May Harbor	<i>Special Restricted</i>
3617B	40.5	10.9	0.012	Cape May Harbor	<i>Special Restricted</i>

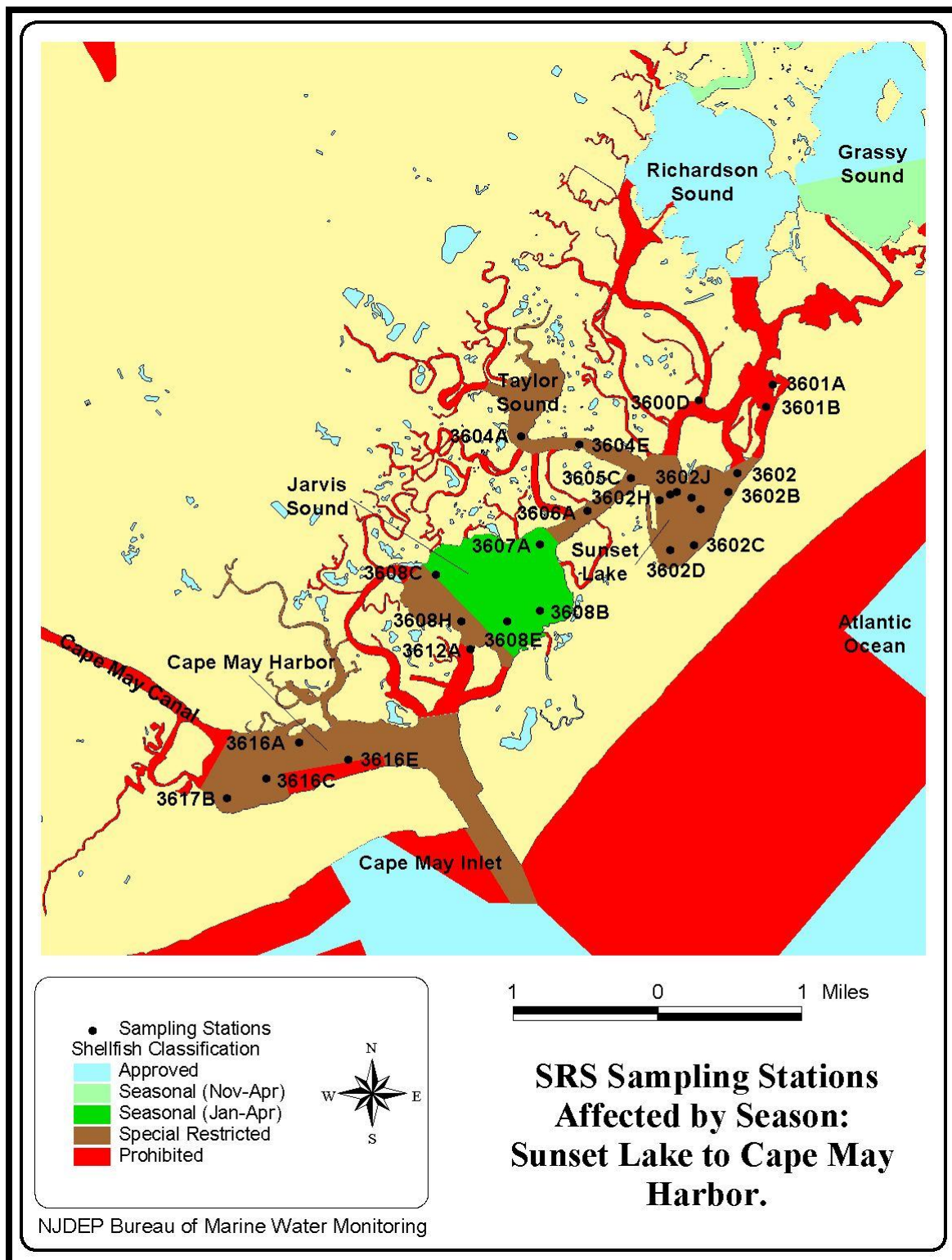


FIGURE 29: SAMPLING STATIONS AFFECTED BY SEASON.

INTERPRETATION AND DISCUSSION OF DATA

BACTERIOLOGICAL

Criteria for bacterial acceptability of shellfish growing waters are provided in the National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish (USPHS, 1999 Revision). Each state must adopt either the total coliform criteria or fecal coliform criteria for growing water classifications. New Jersey bases growing water classifications on the total coliform criteria.

While New Jersey does make corresponding fecal determinations for each total coliform determination, these data are viewed as adjunct information and are not directly used for classification. Therefore, the data analysis is based on the total coliform results.

For the Systematic Random Sampling (SRS) strategy, the total coliform median or geometric mean MPN (most probable number) for the *Approved* shellfish water classification shall not exceed 70/100 mL and the estimated 90th percentile shall not exceed an MPN of 330/100 mL for the three tube decimal dilution test (see Table 3) (USPHS, 1999 Revision). Also, the total coliform median or geometric mean MPN for the *Special Restricted* shellfish water classification shall not exceed 700/100 mL and the estimated 90th percentile shall not exceed an MPN of 3300/100mL, where the three tube

decimal dilution test is used for the Systematic Random Sampling (SRS) strategy (see Table 3) (USPHS, 1999 Revision).

Figure 30 shows the two sampling stations (SRS sampling stations **3618D** and **3612B**) that exceeded the *Approved* total coliform criteria for water quality, year-round, in the summer, and in the winter, after being sampled with the Systematic Random Sampling (SRS) strategy. Sampling station **3618D** is located in Schellenger Creek, west of the Cape May Harbor, in *Prohibited* shellfish waters, and sampling station **3612B** is located in Middle Thorofare in *Prohibited* shellfish waters. These two sampling stations meet the *Special Restricted* shellfish classification criteria. However, the shellfish waters in Schellenger Creek and Middle Thorofare are classified as *Prohibited* because there are marinas located in these areas and, even though marina basin areas are normally classified as *Prohibited* to shellfish harvesting, the boating and fishing activities from these marinas have an impact on the water quality in these two areas. The rest of the sampling stations in this shellfish growing area meet the existing *Seasonally Approved* (January to April), *Special Restricted*, and *Prohibited* total coliform classification criteria, year-round, in the summer, and in the winter.

Based on the water data collected, one sampling station (SRS sampling station **3618D**) showed a significant tidal component for water quality in this shellfish growing area (see Figure 27 and Table 11). SRS sampling station **3618D** is located in Schellenger Creek west of the Cape May Harbor in *Prohibited* shellfish waters. Tidal impacts were evaluated by performing a t-test on log- transformed total coliform MPN values. The sampling stations in this shellfish growing area are not sampled with any tidal preference. SRS sampling station **3618D** had a higher total coliform geometric mean during the ebb tide than during the flood tide. Since the water quality in this shellfish growing area is slightly impacted by tidal effects but not enough to affect the shellfish classification, this shellfish growing area will continue to be sampled using the existing Systematic Random Sampling (SRS) strategy.

A significant correlation between total coliform MPN values from wet/dry data for 10/1/1995 to 9/30/2005 was found to occur at 11 sampling stations in this shellfish growing area (see Figure 28 and Table 12). These 11 sampling stations are located throughout this shellfish growing area in *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish waters. The total coliform levels of these 11 sampling stations still meet the existing *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish classification

criteria for these shellfish waters. Since the water quality in this shellfish growing area is slightly impacted by rainfall but not enough to affect the shellfish classification of this area, this shellfish growing area will continue to be sampled using the existing Systematic Random Sampling (SRS) strategy.

There were 26 sampling stations that showed a seasonal component for water quality in this shellfish growing area (see Figure 29 and Table 13). These SRS sampling stations are located throughout this shellfish growing area in *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish waters. Seasonal effects were assessed using a t-test to compare log-transformed total coliform values for summer versus winter data. All of these sampling stations showed a higher total coliform geometric mean during the summer than during the winter, which is most likely due to increased population pressures resulting from the summer tourism industry (see Table 13). However, the total coliform levels still meet the existing *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish classification criteria for these shellfish waters. Since the water quality in this shellfish growing area is slightly impacted by seasonal effects but not enough to affect the shellfish classification, this shellfish growing area will continue to be sampled using the existing Systematic Random Sampling (SRS) strategy.

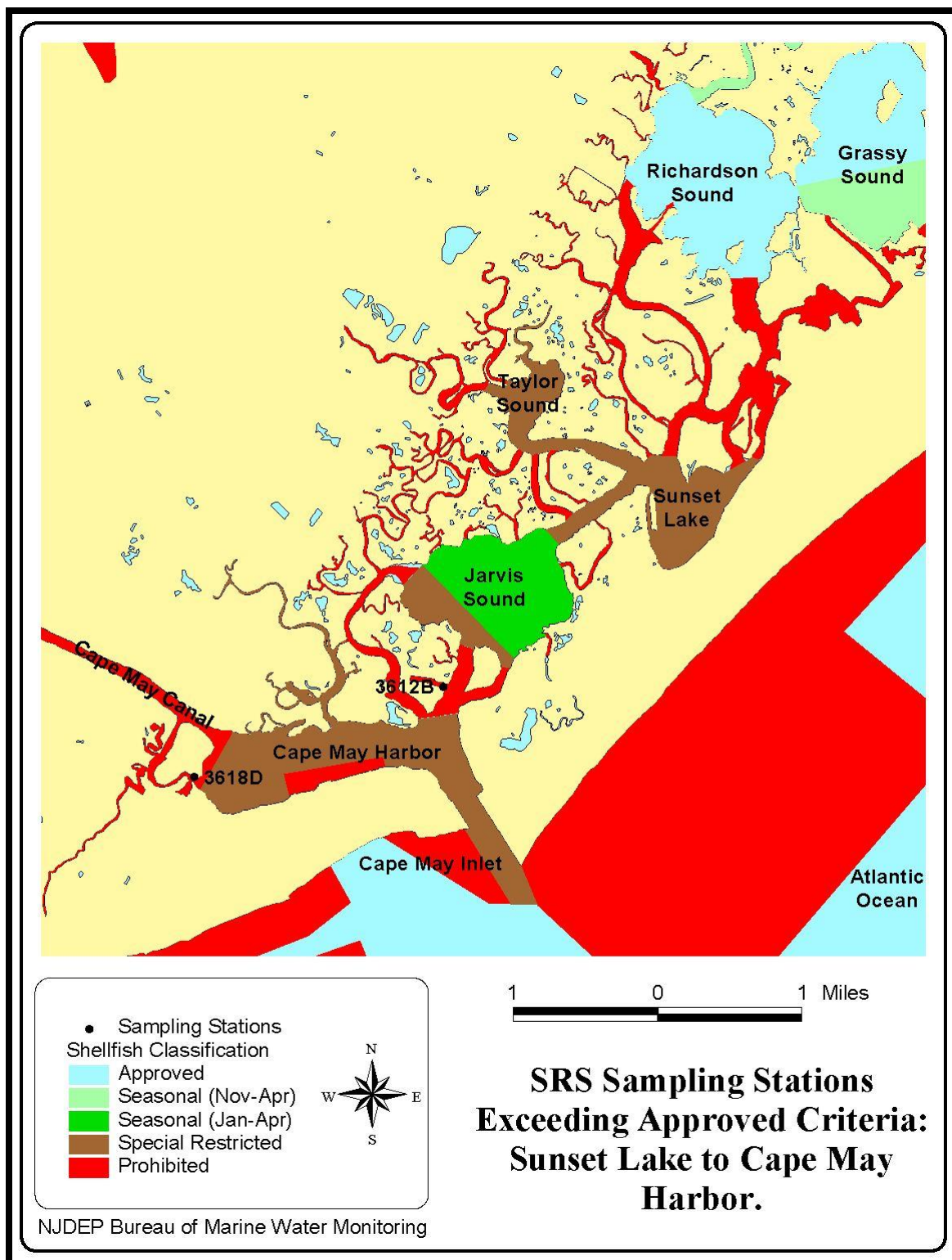


FIGURE 30: SAMPLING STATIONS EXCEEDING APPROVED CRITERIA IN SHELLFISH GROWING AREA SE-7.

RELATED STUDIES

NUTRIENTS

According to the 2004-2005 Marine Water Sampling Assignments Schedule for Assignment 277, there are six stations in Shellfish Growing Area SE-7 that are sampled under the estuarine monitoring program for chemical parameters including nutrients. These nutrient stations include sampling stations **3602D**, **3607A**, **3614A**, **3616B**, **3617A**, and **3618**. They are located throughout this shellfish growing area (see Figure 31).

At these nutrient stations, the various parameters measured include water temperature (in Celsius), salinity levels,

Secchi Depth, total suspended solids, dissolved oxygen levels, ammonia levels, nitrate and nitrite levels, orthophosphate levels, total nitrogen levels, and the inorganic nitrogen to phosphorus ratios (Zimmer, 2001).

For detailed information concerning dissolved oxygen and nutrient levels, see the estuarine monitoring reports published by the NJDEP. These reports, are available electronically at: www.state.nj.us/dep/wmm/bmw.



FIGURE 31: SAMPLING SITES WHERE ADDITIONAL DATA HAS BEEN COLLECTED FOR NUTRIENTS IN SHELLFISH GROWING AREA SE-7.

MARINE BIOTOXINS

There are no phytoplankton sampling stations located within this shellfish growing area.

CONCLUSIONS

BACTERIOLOGICAL EVALUATION

Water quality in Shellfish Growing Area SE-7 continues to be in compliance with the requirements of the *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish classification for the waters in this area, based on NSSP total coliform criteria. All of the stations in this shellfish growing area are sampled using the Systematic Random Sampling (SRS) strategy because there are no adverse pollution sources directly discharging into the waters of this shellfish growing area. These sampling stations meet the *Seasonally Approved (January to April)*, *Special Restricted*, or *Prohibited*

shellfish classification for total coliform, according to the State of New Jersey total coliform criteria.

Shellfish Growing Area SE-7 is correctly classified as *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* as currently described in *N.J.A.C. 7:12*. The Special Restricted waters in this growing area are located where there are many indirect impacts from potential pollution sources, such as marinas and storm water outfall pipes. No classification changes are recommended.

RECOMMENDATIONS

SHELLFISH WATER CLASSIFICATIONS

RECOMMENDED CHANGES IN MONITORING SCHEDULE

Continue sampling using the existing
Systematic Random Sampling (SRS)

Strategy for Assignment 277.

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APPENDICES

- A. Statistical Summaries
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 - Summer Only
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- D. Tidal Evaluation
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